The British 6-In. Howitzer

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This is the first of a series of articles on gunmaking and repairing in English privately owned shops secured with coöperation of the British Ministry of Munitions. The author tells how the product of these shops was changed from their regular output to shell making and then to gunmaking. Considering that neither the staff nor the workmen had experience in gunmaking the results are truly remarkable.

THE series of articles of which this is the first is being prepared with a view to assisting American firms in the manufacture of ordnance which have not previously undertaken such work. The first case selected for illustration is that of an English works, which previous to the war had no sort of ordnance connection. Shortly after the outbreak the works were rescued from a derelict condition and rapidly organized for the production of shells, the only original plant adaptable to this end being two hydraulic forging presses, with their pumping plant, and certain buildings. The works are now producing large quantities of shells up to the 12-in. size.

Twelve months ago the increasing demands for guns made shells of secondary importance, and the government afforded an opportunity to this works to convert some of their shell-machine shops to the manufacture of the 6-in., 26-cwt. howitzer. The change-over from shell to gun manufacture necessitated as a preliminary the removal of a number of hydraulic presses, furnaces and shell machines, together with all the line shafting and countershafting, and an entirely new layout had to be drawn up and the buildings adapted for overhead traveling cranes. Heavy lathes previously used for shell making were adapted to the new requirements of gun manufacture by fitting and bolting extensions to the existing beds and in various other ways. This enabled machines to be brought into service for gun manufacture within six weeks from the time of deciding to make the change.

The problem was dealt with as one of mechanical engineering, and it is worth noting that from the general manager down none of the technical staff or foremen had previously been engaged in gun production or any phase of it. The success of the enterprise was shown by the very first gun rebuilt by them immediately passing the government firing proof at Woolwich. This experience should go far to encourage engineering

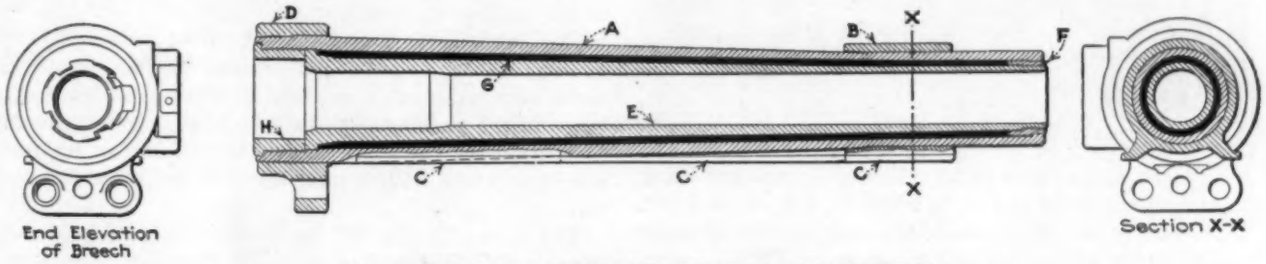


FIG. 1. PRINCIPAL COMPONENT PARTS OF HOWITZER

A, Gun jacket. B, Front guide ring (screwed and shrunk on to muzzle end of gun jacket. C, Guide liners and dust covers. (The first are gun-metal straps fitted on to the front and rear guide feet of the jacket. The dust covers span the space between the front and rear feet and make one continuous slide in the howitzer carriage.) D, Breech ring (screwed and shrunk on at breech end). E, A-tube (jacket shrunk on after being wired). F, Muzzle stop ring (shrunk on A-tube). G, Wire reinforcement of A-tube (wound on tube under tension). H, Breech bush (screwed in while breech is hot). Note—A model breech-bush mechanism is used for finally adjusting the breech bush; the breech mechanism itself is not made at the works under description

firms to tackle with confidence the manufacture of ordnance even if they have previously had no experience in that direction.

Difficulties, if any, may be looked for in boring; that is, the avoidance of ovalities, the wire winding, heat treatment and of course in the fact that the plant will have to be adapted to the work. Lathes, as suggested, are often too short for the new work, and the beds have to be lengthened by additions bolted on, a point that will generally arise when attempt is made to change from ordinary work to gun production.

To return, the work carried out by the firm includes the relining and rebuilding of worn or damaged howitzers sent from the war zone and also the manufacture of new howitzers ready to receive their breech mechanism. The work, in short, is confined to the body.

The main component parts of the howitzer are as shown in Fig. 1.

The over-all length of the howitzer is 87.55 in., the bore is 6 in., and the powder chamber is 6.45 in. in diameter, having a capacity of 390 cu.in. The rifling is polygroove, plain section, 65.475 in. long, with a uniform twist of one turn in 15 calibers, the grooves being 36 in number, and 0.349 in. in width by 0.05 in. in depth.

FIG. 2. HEAT-TREATING FURNACE

The heavy stress to which the components are subjected under service makes it necessary for the steel, 0.3 to 0.4 per cent. carbon, to be of exceptional quality. The requisite improvement of the steel after it has been forged is obtained by heat treatment, the temperatures adopted necessarily varying according to the character of the steel and according to the results desired. The process of heat treatment is threefold: (1) Anneal after forging; (2) heat and quench in oil; (3) reheat for tempering and cool in air.

To cope quickly with the heat treatment of the howitzer components a steel-frame building was erected around a 3-ton* hydraulic luffing crane already standing in the shell-stacking ground. An excavation was made within range of this crane of sufficient depth to enable a water-jacketed oil tank 20 ft. deep to be put in, the tank standing 4 ft. above ground. As will be seen in Fig. 2 the furnace is built up of ordinary firebricks held together by means of wrought-iron straps placed equidistantly from top to bottom of the furnace; the burners are built up of ordinary steam piping and inserted through holes left for that purpose. Further reference will be made, but from the description given it will be noticed that the plant and building are of an extemporized character so as to allow production to be rapidly started.

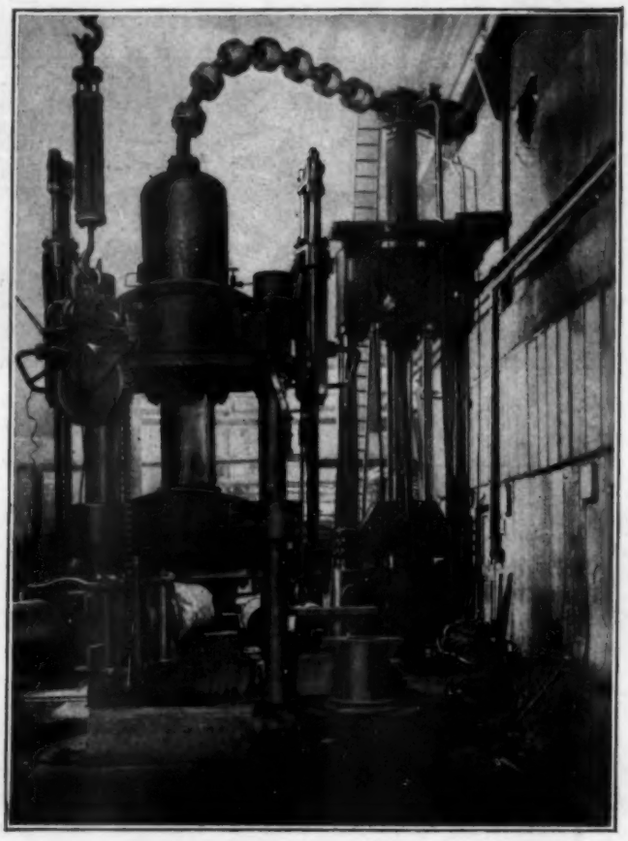


FIG. 3. 1200-(ENGLISH) TON FORGING PRESS

The conditions referred to above of improving the quality of the steel by the process of heat treatment make the question of mechanical tests loom somewhat large in the problems of manufacture, and occasionally forgings have to be retreated before satisfactory tests can be obtained with respect to both tensile and bending tests.

The manufacture of the following principal components is described in the order stated and to the extent indicated:

A-Tube—From the production of the forgings until completely wired ready for shrinking on the finished jacket.

Breech Bush—Machining processes after rough-machining, the forgings being supplied to these works rough-machined and passed test.

*It should be borne in mind that throughout the article the tons referred to are the long or 2400-lb. ton.

Front Guide Rings—Machining operations up to shrinking on the jacket. The forgings are supplied, rough-bored and passed test.

Gun Jacket—Manufacturing operations from the receipt of the solid, rough untreated forgings until final assembly with other components as a complete howitzer.

FIG. 4. A-TUBE FORGING

After this the operations peculiar to the relining and repair of worn and damaged howitzers are dealt with. Consideration is finally given to the inspection routine at the various stages of manufacture.

Gun Jacket—The really restrictive tolerance here is that the ovality of the bore must not be more than four thousandths.

In the case of the front guide ring, breech bush and breech ring, and also on the gun jacket where they are attached, the question of thread location calls for exceptional care in screw-cutting so that the components shall lock up in the predetermined position.

The following operations are performed on the A-tube:

Operation 1.—Forge—The ingot is octagonal in cross-section, 48 in. long and weighs about 50 cwt. (say 5600 lb.). After being heated to 2000 deg. F. in an oil furnace it is conveyed to the forging plant (Fig. 3) made up of a hydraulic press capable of giving a maximum squeeze of 1200 (English) tons, through an intensifier. The forging crane is of the overhead-traveling type, electrically operated, and its functions cover the handling of the ingot into and out of the furnace and manipulating the ingot.

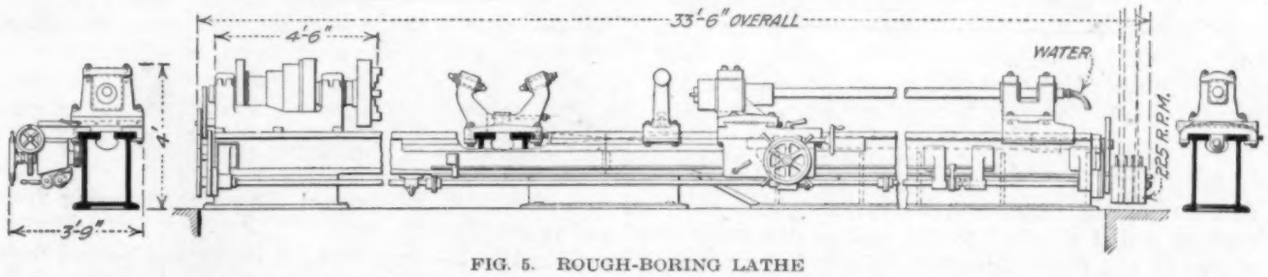


FIG. 5. ROUGH-BORING LATHE

Comment might reasonably be made on the rather extraordinary appearance of the hydraulic-pressure pipe leading from the intensifier to the press cylinder, due to the unusually large number of flanges employed; as solid-drawn tubing of the required size was not obtainable in a reasonable period, the management had to resort to coupling together a number of 6-in. shell forgings which were immediately available.

A-Tube—On the bore is a tolerance of plus or minus three thousandths for the full length of the rifling, but in view of the possibilities of setting up at proof, that is, of expansion when the proof charge is fired, some care is taken to keep to the low limit. For finish-turning over wire no tolerances are authorized, but in practice a minus tolerance of two thousandths is allowed. The tolerances on the depth of chamber are plus five thousandths, minus nothing, and for the cone seating, plus five thousandths, minus nothing. The tolerance on the depth of rifling is minus eight thousandths plus nothing. There is no tolerance on the width of the rifling.

Breech Bush—No tolerances are authorized on diameters or width.

Front Guide Ring—On the bore no tolerances are authorized. The same holds good for that part of the jacket on which the front guide ring fits. In practice a minus tolerance of two thousandths is allowed on the guide ring and a plus tolerance of two thousandths on the jacket.

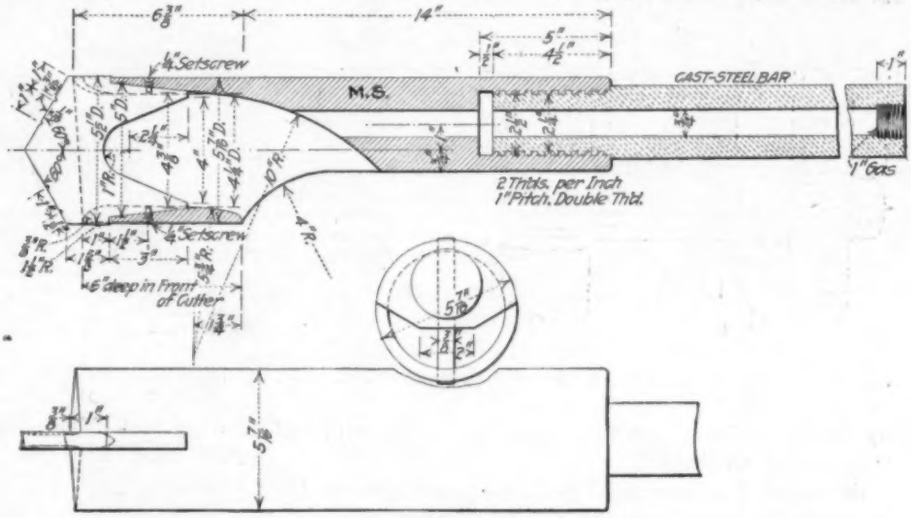


FIG. 6. ROUGH-BORING HEAD

Accuracy of circular forging is procured automatically through the intensifier which controls the stroke of press, and the forging crane is equipped with electric turning-over gear, which rotates the ingot at a speed to suit the rise and fall of the press ram. The

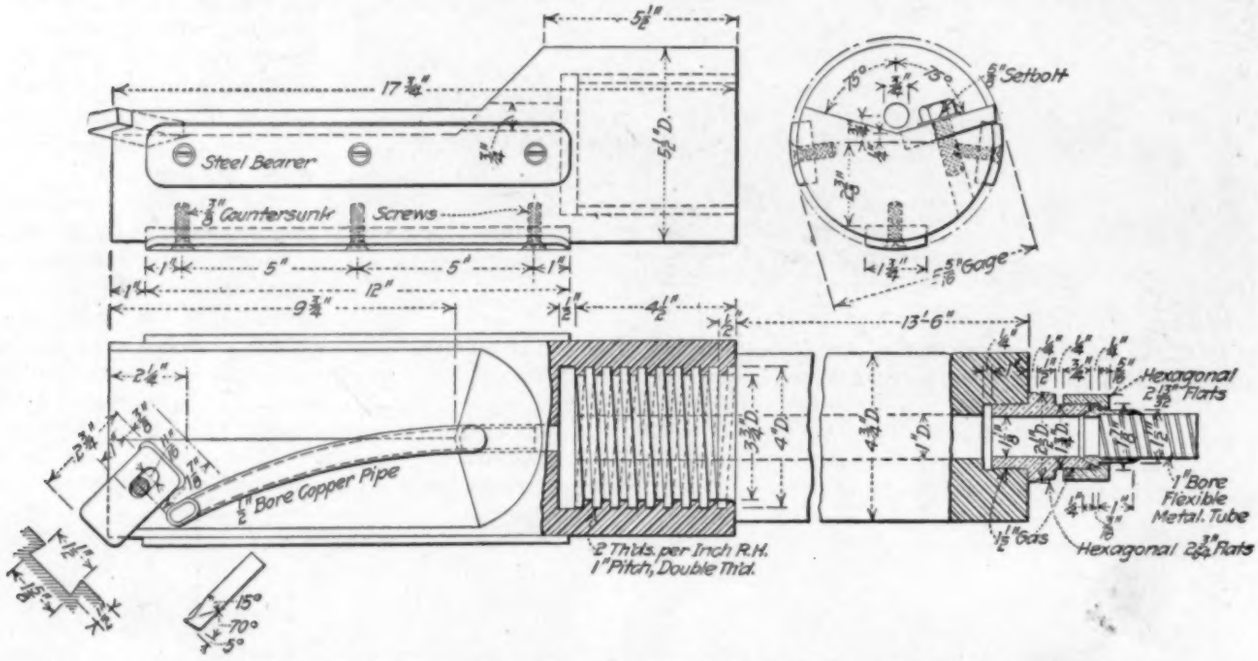


FIG. 7. DETAILS OF THE SECOND-BORING HEAD USED IN OPERATION 14

diameter of the forging in its various stages can be read on a dial attached to the head of the press, the pinion on the finger (pointer) spindle being actuated by a rack worked off the crosshead of the press. The dial is to the right-hand side of the press and being sidewise it cannot easily be seen. The finished forging is shown in Fig. 4. In Fig. 3 attached to the porter bar, it is crane-suspended by means of a chain on the billet-revolving gear through a spring head. For the revolving gear a pawl and ratchet wheel are driven by electric motor at the top, controlled by the wire and lever shown on the left.

Operation 2.—Sawing—The forging is set up on the band-saw to have the rough end removed.

Operation 3.—Center Both Ends—This is done in the lathe by means of an electric drill between the lathe center and the forging.

Operation 4.—Rough-Turn—A heavy 12½-in.-center (25-in. swing) lathe is used, the forging being held between centers and driven by means of a clamp at one end. High-speed steel, 1¼-in. square section, is used, the tool having a top rake 10 deg., clearance 5 deg., cutting speed 34 ft. to 43 ft. per minute, feed 1.1 in. per minute, depth of cut ⅛ in. The forging is reduced to within ½ in. of finished dimension, tapering from end to end.

Operation 5.—Open Out for Rough and Second Bore, Muzzle End—This is done on a 12½-in.-center (25-in. swing) lathe, the breech end being held in a four-jaw chuck and the muzzle end run in a three-point steady-rest. The recess is started with a 1½-in. drill, being opened out to the rough-bore size 5½ in. for a distance of 6 in., and to the second-bore size 5.96 in. for a distance of 3 in., this being done with an ordinary

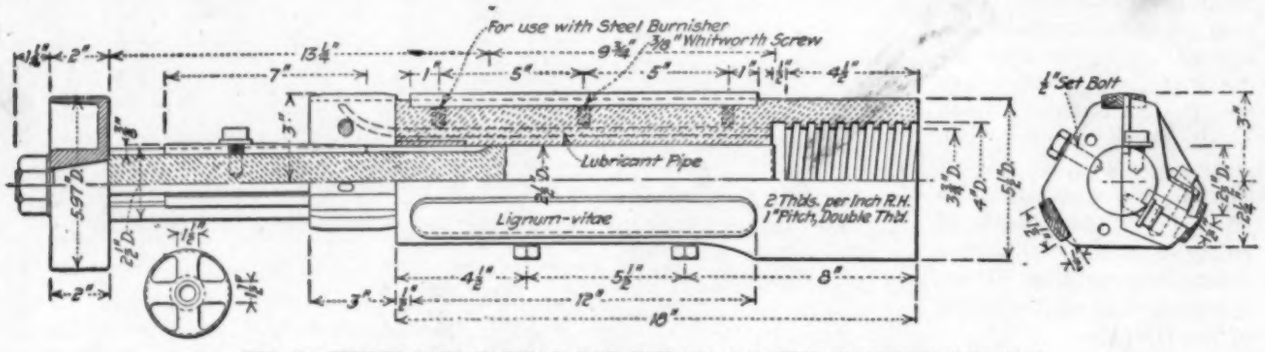


FIG. 8. FINISH-BORING HEAD FOR USE ON A LATHE IN OPERATION 16

boring tool. The object of the opening out is to get a fair start with the rough-boring and second-boring heads.

Operation 6.—Rough Bore—Here a 12½-in.-center (25-in. swing) lathe (Fig. 5) with an extended bed is used, the tube being held at the breech end in a bell chuck and run at muzzle end in a three-point steady-rest. The last is a plain casting with adjustable brass pad at the bottom and brass pads under each adjusting

screw. The boring bar is of cast steel 3¾ in. in diameter, the boring head being attached to this by a square-thread screw. The cutter is of high-speed steel, ⅝ in. thick, 5½ in. wide, V-form, the cutting end having an included angle of 120 deg. The cutter is fitted into a long taper slot in the head on each side, and two small countersunk-head setscrews are inserted to prevent

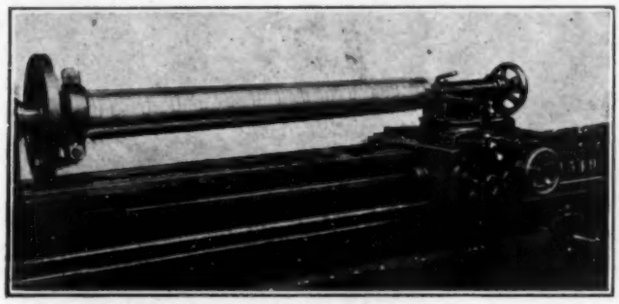


FIG. 9. FINISH-TURNING A-TUBE

the cutter falling out when the bar is withdrawn. Details of the boring head and cutter are given in Fig. 6. The hole is bored through from end to end in one operation, cutting compound being fed through a central hole in the boring bar and by means of a copper pipe through the boring head to the cutter. The feed is worked by means of a central screw running through the lathe bed, but for quick withdrawal and return of the cutter fast and loose pulleys are fitted at the back end of the lathe, and these, by means of clutches and longitudinal shaft, drive the saddle gearing. The pressure of the cutting compound (Niccolite) is equivalent to 40-ft. head. This is the standard pressure and is here necessary in order to keep the tool and boring head clear of swarf (chips and dirt).

Operation 7.—Heat-Treat—The A-tube is now taken to the heat-treatment building and put in a vertical furnace of the type shown in Fig. 2. This furnace is built up in the form of a cylinder 4 ft. 6 in. in diameter outside by 12 ft. high, of ordinary firebrick, and is heated by town gas mixed with air at 2 lb. per square inch, the gas being at 6 in. to 8 in. water gage. The gas consumption is about 1500 cu.ft. per hour. Two sets of burners are fitted, nine on each side of the furnace, arranged tangent-wise to give rotary motion to the heated gases. Pyrometer holes every 2 ft. up the furnace are provided and temperatures are recorded. The A-tube is lifted by means of a bar with a cotter hole at the lower end, the bar being lowered through the A-tube and a cotter inserted; the A-tube is then lifted into the furnace, the cotter withdrawn through an opening located at the lower end of the furnace in Fig. 2, and the bar lifted out of the furnace.

Operation 8.—Anneal—The A-tube is brought up to a temperature of 1500 to 1600 deg. F. and allowed to cool down in the furnace to below 1000 deg. F., this being necessary to eliminate the forging stresses.

Operation 9.—Oil-Harden—The temperature is raised to between 1500 and 1600 deg. F. and maintained for about an hour to insure the heat soaking right through. The tube is then dipped in oil.

Operation 10.—Tempering—After cooling out in the oil the tube is replaced in the furnace and steadily raised to the correct temperature, this being generally between 900 and 1200 deg. F. The tube is then removed from the furnace and cooled in the atmosphere. The temperatures for dipping and tempering are fixed from the analysis of the cast supplied by the steel makers. The oil tank is built up of steel plate and is 6 ft. in diameter inside and 20 ft. deep, 16 ft. of this being below the ground. It has an external water jacket, 6 in. wide, water being circulated to keep the oil at as low a temperature as possible. The oil is also circulated by means of a centrifugal pump. Ordinary petroleum tempering oil is used, having a flash point of 380 deg. F. A false bottom is made of timbers supported from the sides of the tank at the top with chains; this acts as a protection in the case of a forging dropping and also enables easy withdrawal of any article falling into the tank.

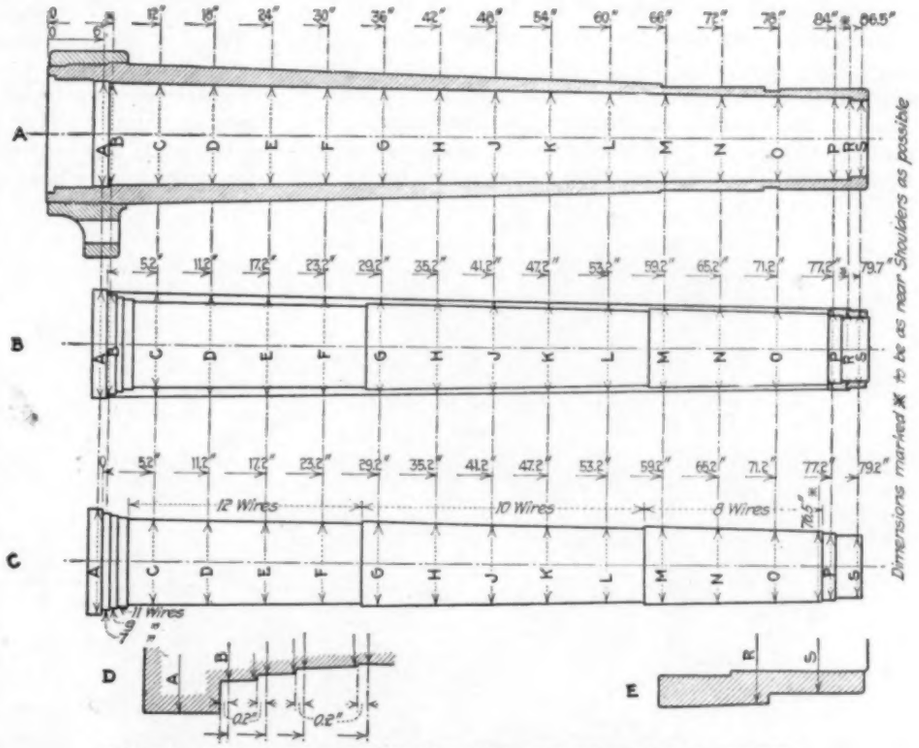


FIG. 10. CHART OF DIMENSIONS FOR FINISH-TURNING A-TUBE

The A-tube now has to pass test before being returned to the machine shop for any further manufacturing operations.

Operation 11.—Part-Off Test Disk—Two test disks are parted off, by lathe or band-saw, 1 in. in thickness—one from the breech end and one from the muzzle end.

Operation 12.—Cut-Up Test Disk and Prepare Test Pieces—Taken into the test-piece shop the test disks are marked off for two tensile and two bender tests from each, the Woolwich examiner transferring his mark onto the position marked off for each test piece. The pieces are then cut out on a slitting saw, after which the marks are again transferred by the Woolwich examiner onto the end of each piece. The tensiles are then finished off in the lathe, and the benders finished off either on a shaping or milling machine.

Operation 13.—Pull Test Pieces—These are pulled on a Buckton beam machine, the tensiles having to stand a load of 34 to 44 tons ultimate, with an extension of not less than 17 per cent., the permanent elongation at 21 tons not to exceed 0.03 in. The test piece is standard size, $\frac{1}{4}$ sq.in. in area, with an acting length of 2 in. The benders are $4\frac{1}{2}$ in. by $\frac{3}{4}$ in. by $\frac{3}{4}$ in., and must bend to 180 deg. without breaking, the size of the gap being $2\frac{3}{8}$ in. and the diameter of the pusher $1\frac{1}{2}$ in.

After passing test, the forging is stamped with the "Passed Test" mark by the Woolwich examiner and is returned to the machine shop for the finishing operations.

Operation 14.—Second-Bore—A $12\frac{1}{2}$-in.-center (25-in. swing) lathe with extended bed, as described in Operation 6 for rough-boring, is used. The boring head is detailed in Fig. 7. The cutting compound is delivered through the center of the bar and through a $\frac{1}{2}$-in. copper pipe onto the single cutter. The cutter is of high-speed steel $2\frac{1}{2}$ in. by $1\frac{1}{8}$ in. by $\frac{1}{2}$ in. thick, dovetailed into the cast-iron head and secured by a single $\frac{5}{8}$-in. set bolt (capscrew) as illustrated. The bearing strips usually fitted to the boring head are of lignum-vitæ, the wear on these being taken up by the insertion of brown paper underneath. The cutter is set to the tube end where it is opened out to the second-bore size (Operation 5). The second-boring cutting speed is 15 ft. per minute and the feed 0.2 in. per minute.

Operation 15.—Second-Turn—An ordinary lathe is employed; expanding-cone centers are fitted into the tube ends, and the tube runs between the centers, being driven by means of a clamp, as for rough-turning. High-speed steel is used, $1\frac{1}{4}$-in. square section; cutting speed is 33 ft. to 41 ft. per minute; feed, 1.1 in. per minute; depth of cut varying from $\frac{3}{16}$ in. to $\frac{1}{4}$ in. The forging is turned within 0.3 in. of the finished diameter.

Operation 16.—Finish-Bore—This is done on a lathe fitted with an extended bed, the breech end being held in a bell chuck and the muzzle end run in a three-point steadyrest, the machine being similar in every respect to that used for rough and second boring. The boring head is shown in detail in Fig. 8. The three cutting tools are each $\frac{1}{2}$ in. thick by $1\frac{3}{4}$ in. by 3 in. secured by one $\frac{1}{2}$-in. bolt; the angle is 75 deg. The illustration shows a cylindrical guide in front of the cutters. It, however, is not now used. This guide, running in the second bore, was found to transfer any irregularities there existing to the finished bore. The cutters are set up by means of a casting which slips on the small diameter of the boring head; in this there are three registers for the cutters. The casting is slipped up over the cutters and the taper-wedge piece below each cutter is tapped in until a 0.002-in. feeler can be just inserted between the cutter and the register. The casting is then removed and the cutters are secured in position by the $\frac{1}{2}$-in. bolt previously mentioned. Cutting compound is supplied separately to each cutter by means of a passageway through the boring head. The finish-boring size is 6.000 in.; cutting speed, 10 ft. per minute; feed, 0.55 in. per minute.

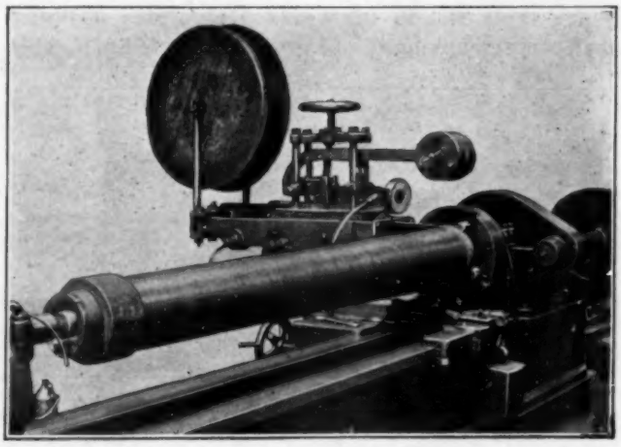


FIG. 12. WIRE-WINDING LATHE

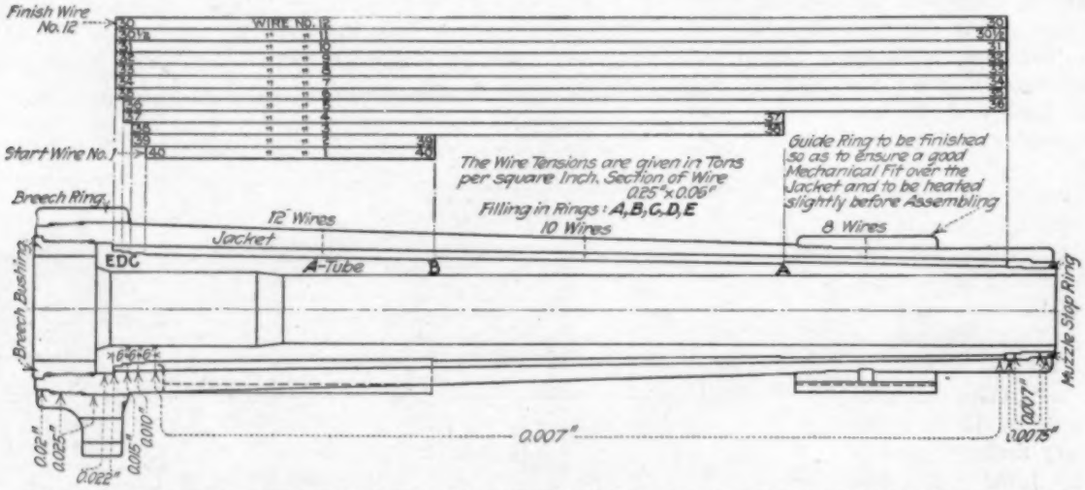


FIG. 11. WIRE-TENSION CHART SHOWING DECREASE IN TENSION IN OUTER WIRES AND SHRINKAGE ALLOWANCES

Operation 17.—Finish-Turn for Wire—This is done on an ordinary lathe (Fig. 9), the dimensions being taken from the chart, a reproduction of which is given in Fig. 10. The correct dimensions are spotted off

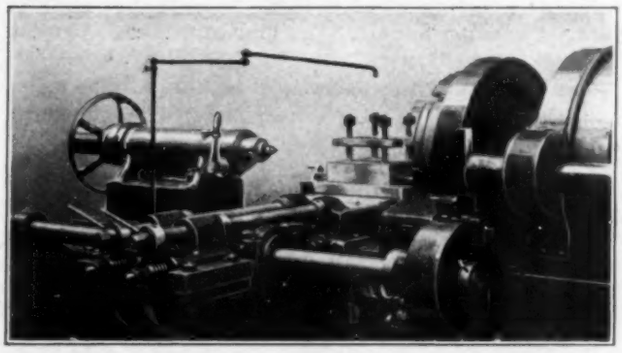


FIG. 15. JUMP LATHE (DEAN, SMITH & GRACE), BACK

on the A-tube every six inches of its length, corresponding to the positions given on the chart. The spaces between these spottings are then blended off. This operation is one of the most important, and no tolerance is authorized on these diameters, though in practice a minus tolerance of 0.002 in. is allowed. The chart is prepared by gaging the jacket after finish-boring on the vertical and horizontal axis with a rock-over vernier gage, these measurements being marked up on the chart at *A*. At *B* on the chart the dimensions over the wire are given and at the corresponding positions at *C* are given the dimensions to which the A-tube is to be turned for wire. The dimensions given at *B* and *C* on the chart are obtained from the dimensions given at *A*, due allowance being made for thickness and number of layers of wire, collapse due to wiring and shrinkage allowance over wire given in Fig. 11. At *D*, Fig. 10, are the dimensions of the shoulders at the breech end and at *E* the diameters over the muzzle stop ring.

Operation 18.—Shrink-On Muzzle Stop Ring — The shrinkage allowance on this is 0.007 in., and the muzzle stop ring is shrunk on by heating in a gas ring and clamping in position until cold.

Operation 19.—Wire Wind —The wire winding is done on an ordinary lathe fitted with a tensioning device described later. The wire is 0.25 in. wide and 0.06 in. thick. The starting end is secured by cutting a slot in line with the axis in the shoulder at the breech end of the A-tube with a cross-cut (cape) chisel. The wire is then heated at the end and bent to a right angle; it is then inserted in the slot and the metal riveted over the wire. The wire is then wound on in the usual way, the lathe head revolving while the saddle traverses the bed of the machine. The finishing end is clipped (clamped) to prevent unwinding, a groove in the collar is chiseled at an angle to the tube axis, the wire is heated and bent to suit, and a calking piece is put in and the groove closed. Joints in the length are made by lapping the two ends together, giving a bearing length of about three inches, brazing the two and filing the overlapping ends to a long taper so that the depth remains

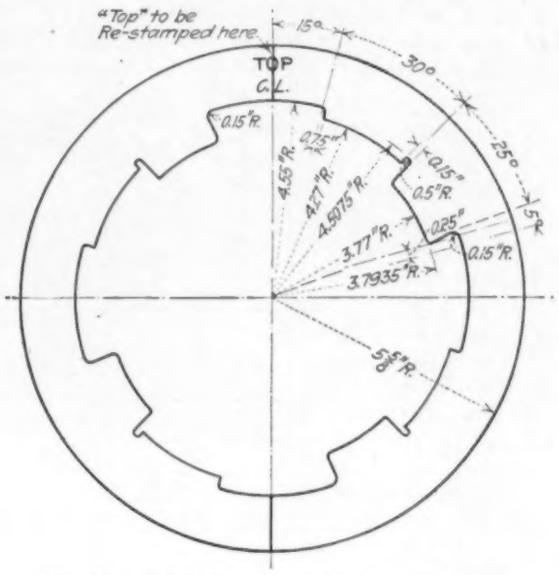


FIG. 13. TEMPLET FOR BREECH BUSHING

constant. The tensions are given on Fig. 11 and amount to 40 tons per square inch on the first layer, falling by 1 ton per layer, except that the last two are varied by ½ ton. The speed is 34 r.p.m. The wiring machine is illustrated in Fig. 12. On the bed is a saddle which

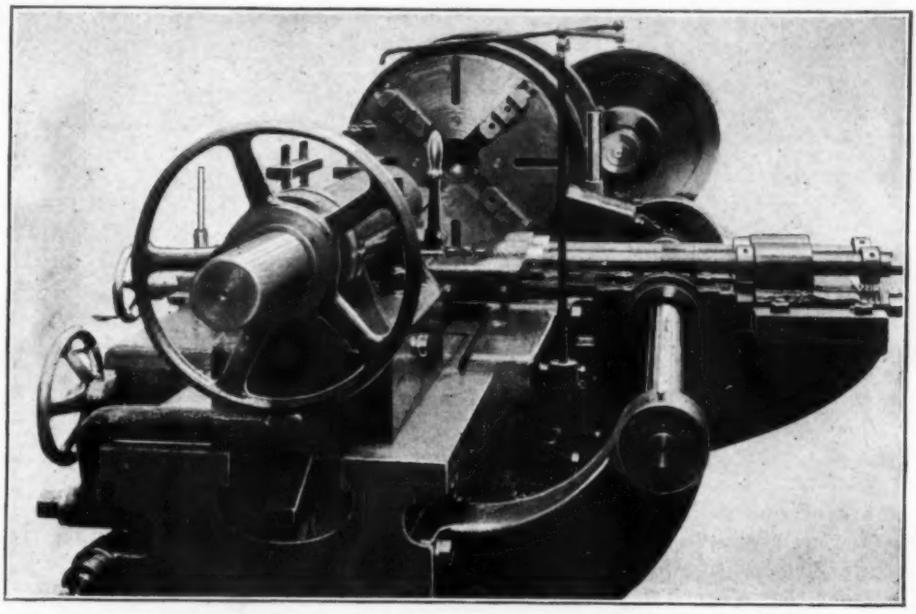


FIG. 14. JUMP LATHE (DEAN, SMITH & GRACE), END VIEW

carries the drum of wire and the tensioning device. The wire passes from the reel through hard cast-iron dies, each secured in a block that can be adjusted by a wedge piece to take up wear. The tension is put on the wire by forcing the dies toward one another, the adjustable weight and lever shown acting through a

thrust rod onto a toggle to effect this. The cradle through which the wire is drawn is free to move in the direction of the wire, the resistance to this motion being supplied by a horizontal hydraulic cylinder at the back of the machine just visible below the wire reel in the illustration. The ram is connected by drag rods to the cradle. The diameter of this ram has an area of 5 sq.in., so that a pull of 1000 lb. on the wire would give 200 lb. per square inch in the cylinder. Should the wire tend to stick in the dies through which it passes, due to local increase in thickness or other causes, an excessive pressure would be produced in the rear cylinder. This would be communicated to the relief cylinder shown below the center of the lever and would at once reduce the load on the wire by partly opposing the weight on the lever. This automatically regulates the tension on the wire. It can, however, also be controlled by hand, the operator working the lever from the front of the machine. The tension on the wire can be read off at any time during the winding process by means of the pressure gage facing the operator, the gage indicating the tensions required in the layers.

Operation 20.—Finish-Turn Over Wire and Muzzle Stop Ring—This is done on an ordinary lathe, the dimensions being taken from the chart mentioned under Operation 16, the tube being spotted off in the same way. The cutting speed is 13 ft. to 16 ft. per minute; feed, 0.78 in. per minute. The lubricant used is paraffin (kerosene).

This completes the operations on the A-tube up to being ready for shrinking on the jacket. The finishing operations will follow the operation No. 26 on the jacket.

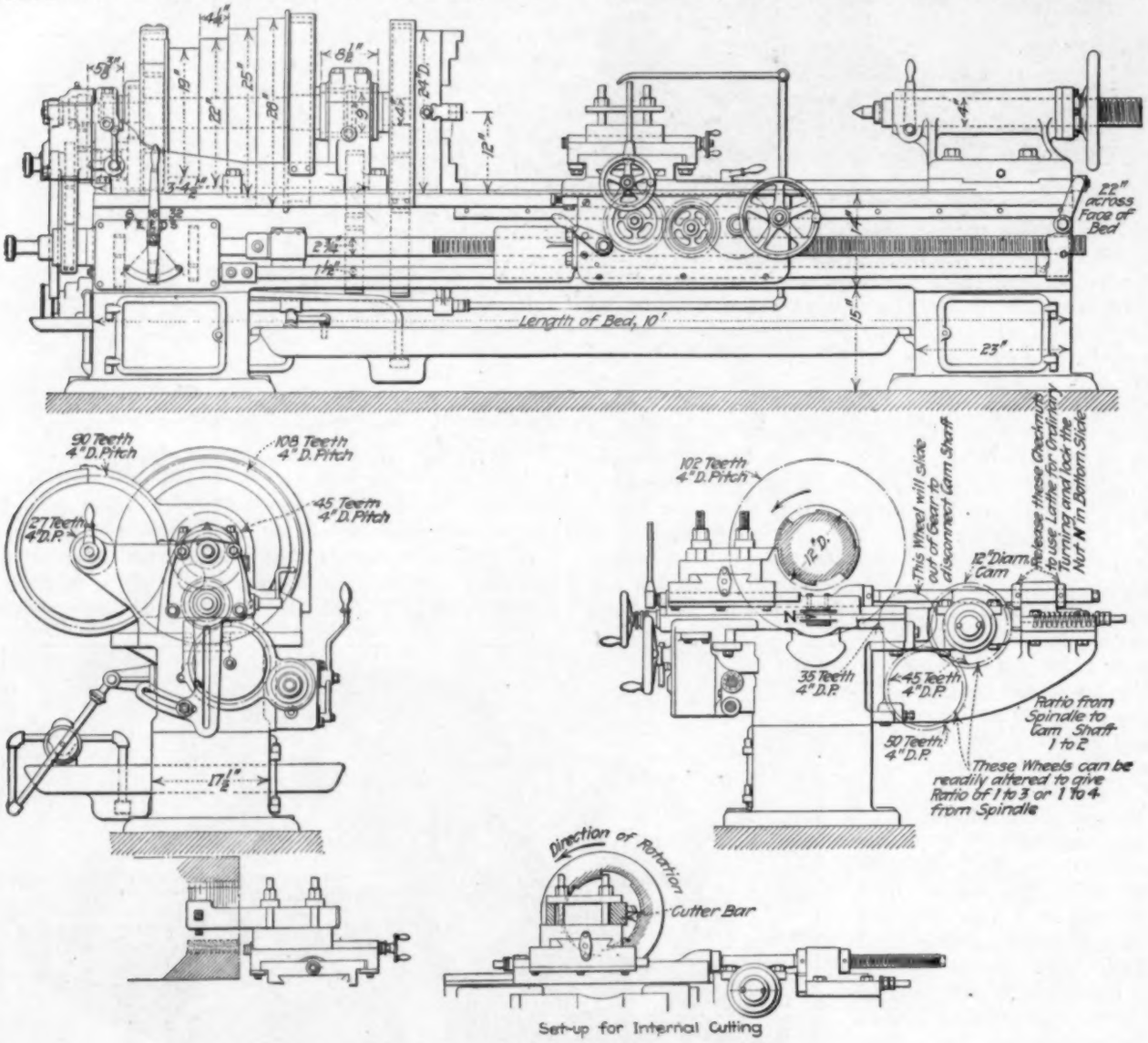

Length of Bed, 10'
22" across Face of Bed
23"
15"
12"
90 Teeth 4" D.Pitch
108 Teeth 4" D.Pitch
45 Teeth 4" D.Pitch
27 Teeth 4" D.P.
102 Teeth 4" D.Pitch
12" D.
This Wheel will slide out of Gear to disconnect Cam Shaft
12" Diam. Cam
Release these Checknuts to use Lathe for Ordinary Turning and lock the Nut N in Bottom Slide
35 Teeth 4" D.P.
45 Teeth 4" D.P.
50 Teeth 4" D.P.
Ratio from Spindle to Cam Shaft 1 to 2
These Wheels can be readily altered to give Ratio of 1 to 3 or 1 to 4 from Spindle
Direction of Rotation
Cutter Bar
Set-up for Internal Cutting

FIG. 16. JUMP LATHE (DEAN, SMITH & GRACE)

The breech bushes are received after rough-boring and rough-turning ready parted off into lengths to make one bush.

Operation 1.—Rough-Bore and Rough-Turn—The bush is held in an ordinary four-jaw chuck and rough-bored to 7.125 in. and rough-turned to 11.8 in.

Operation 2.—Finish-Turn and Face, also screw-cut external threads.

Operation 3.—Face to length.

The foregoing are fairly ordinary operations.

Operation 5.—Slot Recess and Clearances for Welin Thread—This is done by means of a templet shown in

Fig. 13. (Welin was the inventor of the particular type of screw.) For the Welin thread here used each quarter of the bore is in three sections, each of different diameters, the plain section for the entry of the breech block being of course the largest. The other two sections are step-threaded.

Operation 4.—Slot Recess and Clearances for Welin Thread—An 18-in. slotting machine is used, the operation taking 6 hours.

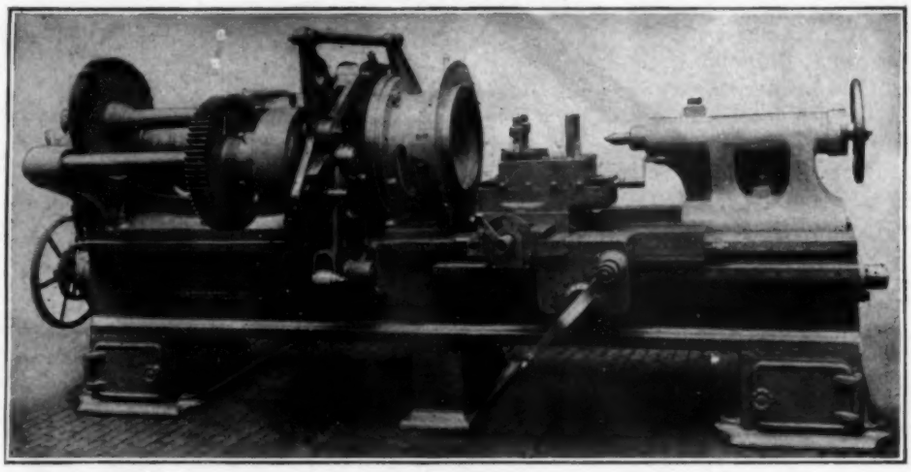


FIG. 17. JUMP LATHE (ARMSTRONG, WHITWORTH & CO., LTD.)

Operation 6.—Finish-Bore and Cut Welin Thread—This is done on a Dean, Smith & Grace or Armstrong-Whitworth jump lathe, the operation taking 6 hours.

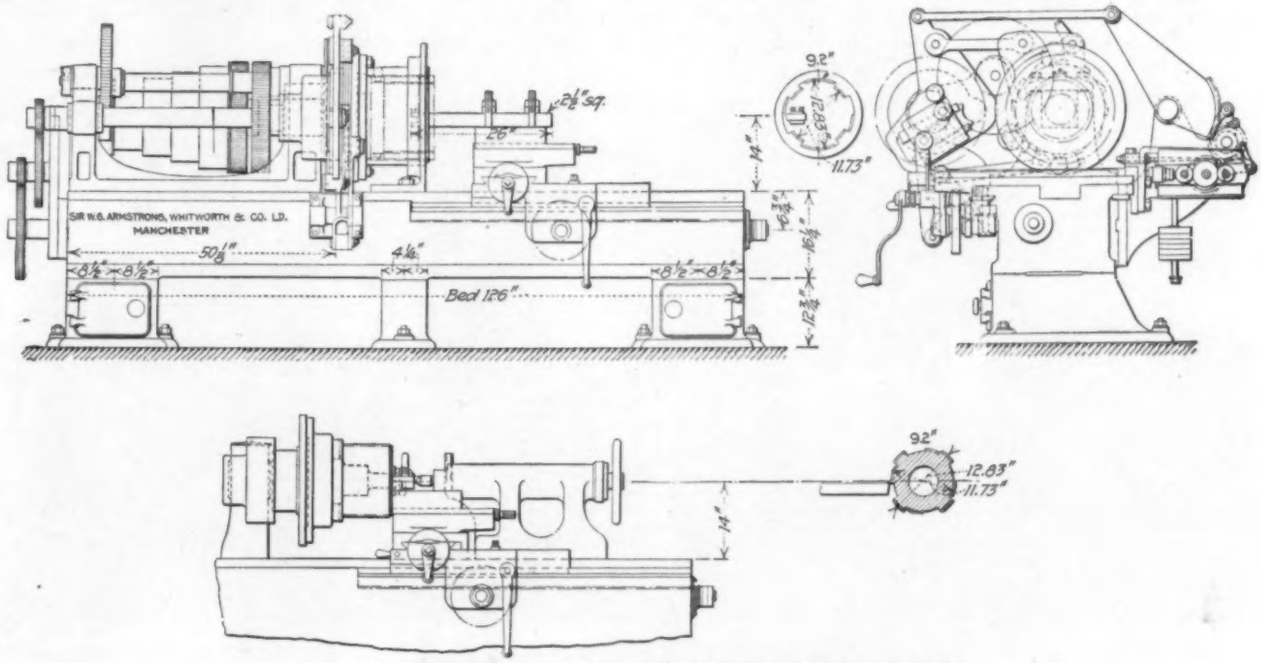


FIG. 18. JUMP LATHE (ARMSTRONG, WHITWORTH & CO., LTD.)

The essential features of the Dean, Smith & Grace lathe for cutting the Welin thread are shown in Figs. 14 and 15. It is used for threading both gun breech blocks and bushes, the two methods of setting up being illustrated in Fig. 16. In this lathe the tool is moved in and out across the bed during certain periods of a revolution to cut a thread on two different radii, this movement being obtained from a cam carried in a bracket attached to the back of the saddle. The bracket also carries a sliding block with a steel die bearing against the cam and kept in contact by two strong springs. Two adjustable rods connect the die block to the tool slides. The cam is held by sliding keys to a shaft driven from a gear on the back of the chuck at a ratio of 2, 3 or 4 to 1, according to the number of series of steps on the work. By rack and pinion an intermediate wheel can be moved out of gear, thus disconnecting the cam motion. The cam has two concentric portions of different radii, with a gradual change from one to the other, and also a sudden step down from large to small radius. In operation the tool cuts one radius of thread, jumps out to the other radius, $\frac{1}{4}$ in. or less room being allowed for this, and feeds in gradually across the large gap between the threads ready for the next series. The saddle and tool are simultaneously traversed along the bed by the usual lead screw and nut. An intermediate in-cutting (cross-feed) slide is provided for putting the cut on; also a slide at right angles, both with fine adjustments. When cutting the breech bushes the tool is moved to the back of the lathe center and is held reversed in a toolholder. This avoids reversing the motion of any part of the machine.

The slides are all-steel castings. The brackets for carrying cam and gears, also gears and shaft, are purposely made unusually massive to absorb the shock when the tool jumps, and every part is simple and strong to eliminate any risk of breakdown. The ratio of the gear from chuck to camshaft can readily be altered by chang-

ing two wheels; these wheels are at fixed centers to insure stiffness, no banjo or swing plate being used. The rod connecting the die block to the tool slides can be disconnected for ordinary turning, the nut on the saddle screw being held to the slide by a stiff pin and screws which are withdrawn when the jumping gear is being used. In other respects the lathe is a standard 12-in.-center (24-in. swing) lathe.

The jump lathe manufactured by Armstrong, Whitworth & Co., Ltd. (Fig. 17), is somewhat different in construction. It is a 14-in.-center (28-in. swing) machine, so that the Welin thread on breech blocks and breech bushes for 6-in., 8-in. and 9.2-in. guns can be produced. Referring to Fig. 18, to cut the thread on breech blocks, these are placed on a mandrel between the centers, as shown in the upper view, the cutting tool being fastened in the slide rest as usual. The breech bushes are screwed into a chuck on the lathe faceplate, and the cutting tool is held in a square bar for internal cutting, as shown in the lower view.

The Armstrong-Whitworth Lathe

The outstanding feature of the Armstrong-Whitworth jump lathe is that the lathe spindle does not have a continuous rotary motion while in use for cutting the Welin thread, but is driven by means of a ratchet wheel and pawls worked from plate disks and levers, the tool being brought to the correct position for cutting the threads by means of a motion on a side shaft at the back of the machine. The fast head (head stock) is double geared for ordinary turning, if necessary, but when dealing with the threads of the breech screws or bushes the pinion of the second shaft on the head is geared into the spur wheel on the shaft in front of the headstock, and the front end of this shaft is fitted with a disk, pin and sliding block which work in the slot of a crank lever, giving an oscillating movement to this lever and, by connecting-rod, an oscillating movement to the plates running loose on the fast headstock spindle. A pawl in connection with these plates gives motion to the ratchet wheel keyed on the lathe spindle and an intermittent movement to the work results. In this way there would be as many intermittent movements to the work as there are teeth in the ratchet wheel. As there are, however, spaces between certain threads these spaces are quickly jumped on the return stroke of the ratchet pawl. This is effected by the action of levers attached to the front of the first oscillating lever and connecting-rod and ratchet pawl on the underside of the main ratchet wheel, this particular ratchet pawl being allowed to fall into gear with the ratchet wheel by the action of a cam plate at the time the space between the threads on the breech screw comes opposite the cutting tool. As the faceplate carrying the work comes to rest, and while the oscillating levers and the ratchet are on the return stroke, the top rest with the tool is withdrawn from the work to the correct position to meet the next thread.

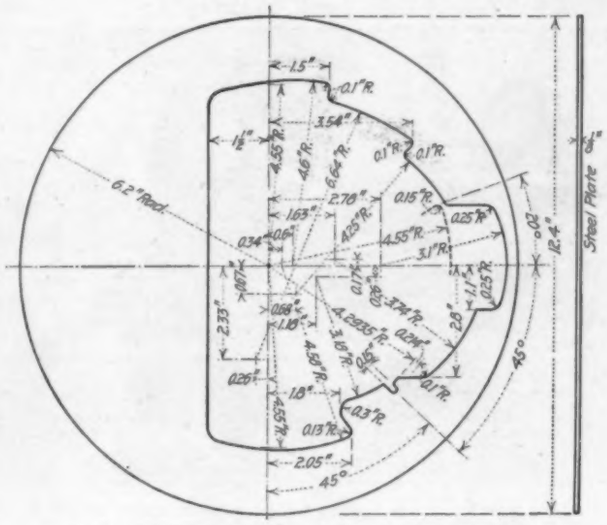
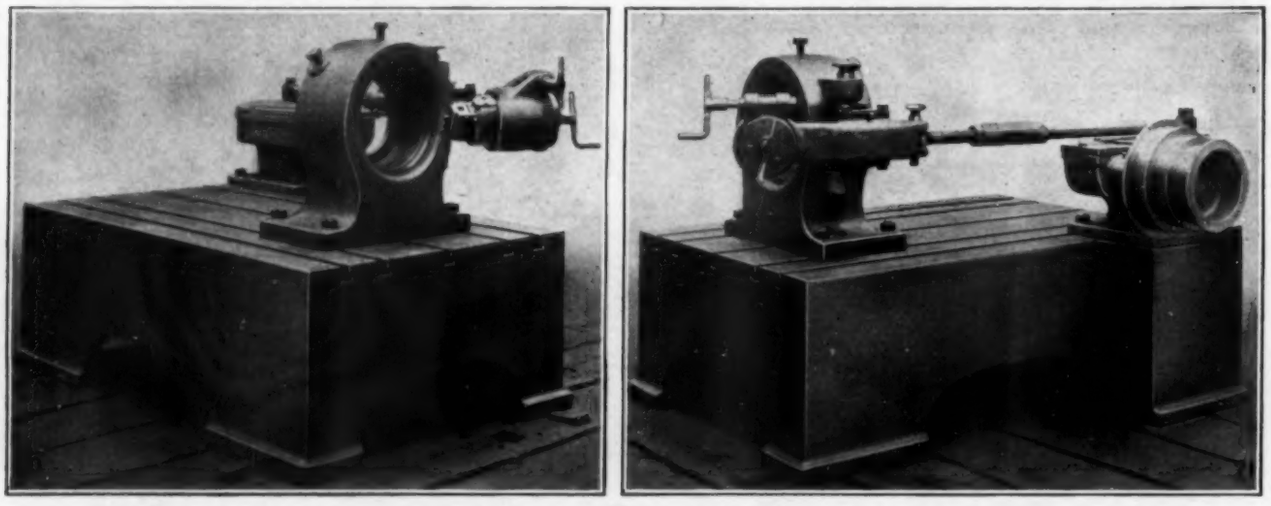


FIG. 19. TEMPLET FOR RADIAL SHAPING



FIGS. 20 AND 21. RADIAL SHAPING MACHINE

This movement is obtained from the first oscillating lever in front of the headstock and a connecting-rod and lever segment, giving motion through a shaft and gear to a cam on the slide behind the saddle. This cam throws the tool slides into the correct position to meet the threads on the screws alternately, inwardly and outwardly.

Operation 7.—Mark-Off for Radial Shaping—The templet shown in Fig. 19 is employed.

Operation 8.—Radial Shaping—The object of this is to put an internal and external radius on the bush to enable the breech block to be swung in. A special machine constructed by Craven Bros., Ltd., is used. This imitates the motion of the breech block. The same machine will deal with breech bushes either before or after they have been inserted into the gun in sizes

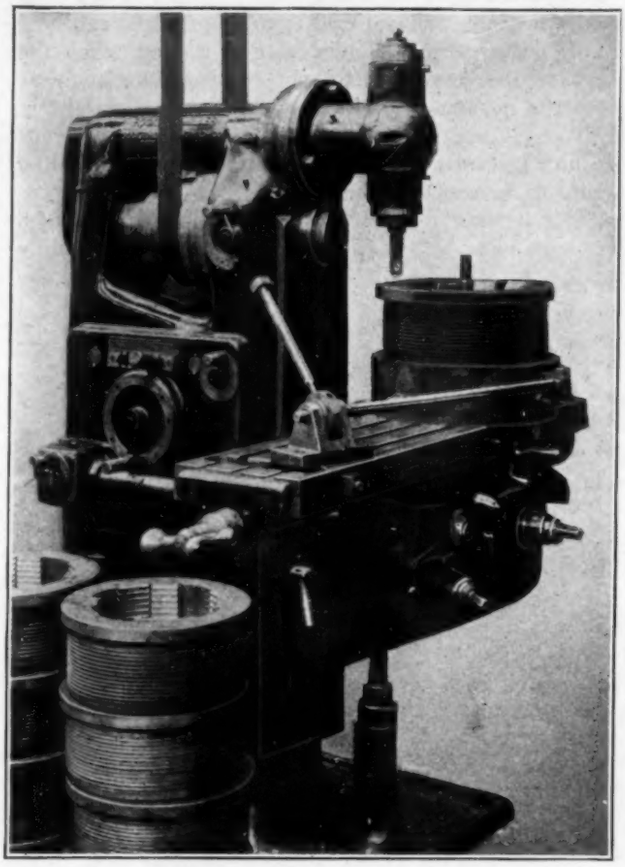


FIG. 22. MILLING CAM RECESS ON BREECH BUSHING

up to the 9.2-in. howitzers. The breech bush is clamped in a bracket (Figs. 20 and 21) bolted to the top of the table, the bracket having a hinged pin forming a fulcrum for the radial arm, the pin being relatively in the same position to the center of the gun as the pin on which the breech block swings. Thus, incidentally, the brackets of the swinging arm require to be modified for each size of gun. The shaping arm bears a circular toolbox having a swivel and cross-adjustment by hand to put on the cut. The toolbox has a flapper and slide, and an extension toolholder is supplied to shape out clearances past a line drawn through the hinged pin at right angles to the gun. The shaping arm has reciprocating motion driven by a three-speed cone pulley driven from overhead. The connection is made by a rod at one end of the arm, the driving end of the rod being adjustable for length of stroke by bolt and slotted disk. The disk is carried in a bracket bolted to the table and is driven by worm and wormwheel from the cone-pulley shaft.

Operation 9.—Fitting and Blending the Welin Thread—This operation consists of rounding up the start of the Welin thread at each break to insure ease of entry to the breech block. It is a tedious hand operation with a file, the ring being held in the vise.

Operation 10.—Milling Recess for Cam-Rotating Gear—The work is done on a vertical milling machine, the breech bush being clamped onto a jig to insure accuracy. The jig is then revolved for the feed by means of a nut and tommy bar (connecting-rod) shown in Fig. 22.

The front guide rings are received in sticks (bars), which have already passed test, of sufficient length to make four to six rings.

Operation 1.—Saw Off to Length—This is done on a band-saw (Fig. 23), the time taken being 6 hours.

Operation 2.—Rough-Bore and Face Both Ends—An ordinary heavy-duty lathe is used for this and the following.

Operation 3.—Finish-Bore and Screw Cut.

Operation 4.—Mill Exterior—The guide ring is screwed into the vertical mandrel shown in Fig. 24, which is built up on the lathe saddle. It is then fed to the milling cutter until the cutter reaches the required depth, when the mandrel carrying the guide ring is rotated by means of the worm and wormwheel shown, the worm being driven by chain and sprocket wheels from the feed shaft on the side of the lathe. The fixture for carrying the vertical milling cutter can be clearly seen in the figure. The Francis cutter used is of the built-up type, the teeth being high-speed steel and

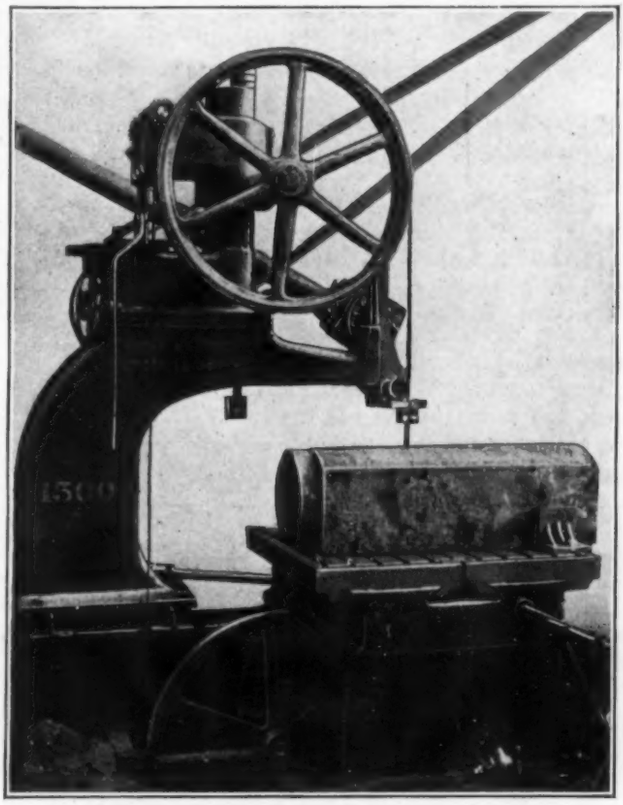


FIG. 23. SAWING OFF FRONT GUIDE RINGS

fixed in a helix by means of wedge pads secured with setscrews in the center. With this special milling cutter the time taken to mill the exterior is only 2½ hours as against 25 to 30 hours when slotted. The illustration shows the method of adapting the lathe.

Operation 5.—Face to length.

Operation 6.—Finish-Slot Arches of Feet and Semi-Finish Flat Faces of Feet—Sufficient stock is left on

the feet for skimming up after the guide ring is shrunk in position on the jacket. Here, to anticipate, they are planed in order that they may be in line with the other feet.

Operation 7.—Radius Both Ends—A 12½-in.-center (25-in. swing) lathe is arranged for this, the guide

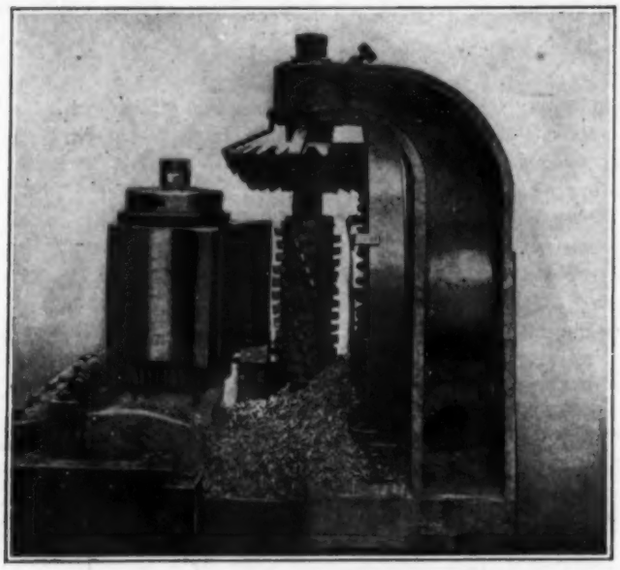


FIG. 24. MILLING FRONT GUIDE RING

ring fitting a register on the faceplate to which it is held by a central bolt and plate. A cam is attached to the faceplate and gives the required motion to the saddle to enable the radius tool to properly clear the guide feet.

A Safe Load Chart for Rope Slings

By F. W. Salmon

Tables have been published giving the safe load on almost all kinds of hoisting tackle, and yet they are seldom employed by the men most concerned—the workmen and foremen who use the tackle. There are several reasons for this, but probably the most potent is that the workman could not hold his job if he took the

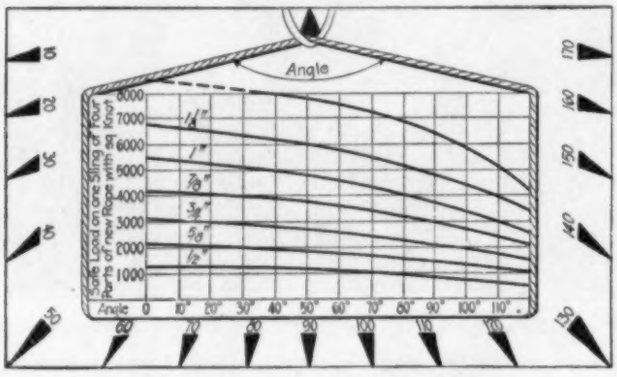


FIG. 1. LOAD CHART FOR ROPE SLINGS

time to measure the angles with an inclinometer and refer to his tables every time a load is to be lifted.

This chart is intended to meet the requirements of practical men and lead to greater efficiency by reducing accidents and breakage without necessitating the use of excessively heavy slings for light loads. A card, Fig. 1, about 3½ x 6 in. is divided around the edge as a protractor, every 10 deg. being marked with a plain black triangle. In the center space appears a chart of the safe loads based upon the particular kinds and sizes of slings that are used in the shop, while upon the back of the card is printed directions for its use.

This card can be carried by the foreman in his time book; when any unusual load is to be lifted he can hold it up in the manner shown in Fig. 2, and when the sling just becomes taut he can estimate the angle to about the nearest degree. Having the total weight to be lifted he can run his finger up the chart to the rope size and instantly determine whether or not the sling is safe to handle the load.

The following example shows the manner in which the chart is to be used: Load to be lifted, including packing, is 2500 lb. Rope, good new ¾-in. manila, dry

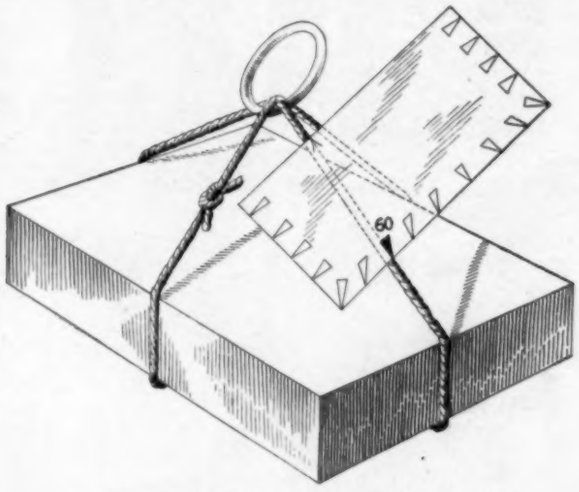


FIG. 2. MANNER OF USING THE CHART

and in good condition, made up with a square knot; hoisting to be done gently so that the inertia of the weight lifted will not materially increase the stress upon the ropes; angle shown by chart is 60 deg. By running up the 60-deg. ordinate to the ¾-in. diameter rope, we see at once that it should safely carry this load.

I do not know that this device has ever been used before. There is no patent or other restriction upon its use, and I am passing it along in the hope that progressive men may find it of advantage to them in their work.

Improved Lathe Centers

By G. Strom

On page 32 is shown a lathe center with a high-speed-steel insert. The use of high-speed steel for this purpose seems to be little known except by those who have had trouble with carbon-steel centers. I have used centers of this material for eight years on speed and engine lathes up to 87 in. swing and upon various grades and weights of work up to 2500 lb., and during this period I have experienced no trouble from centers softening or seizing and wringing off in the work.

I always use a plain center without oil grooves, and on heavy pieces I cut three narrow V-shaped grooves in the work.

Using a Punch Press in Lieu of Bending Rolls

By J. V. HUNTER
Western Editor *American Machinist*

A brief description is here set forth of the way in which awkward and annoying jobs involving the bending and forming of sheet metal may be rendered simple and easy by means of a few cheaply made dies of hard wood used in the ordinary form of punch press to be found in any structural shop.

HAVE you a set of rolls in your shop that will take steel sheets in any thickness up to half an inch and roll them lengthwise in any length that you can get into the shop? That will mean a set of rolls of greater length than any to be found in the country; yet this result can be accomplished on the ordinary sizes of structural-shop punch press and at a comparatively rapid rate—not so fast as a set of rolls would do it, of course, but many times faster and more satisfactorily than the same work could be done by the usual hand methods with fuller and sledge.

In addition to the punch press the equipment required will be several very economically produced dies of plain hard wood and holders for these if your press has no "knees" and die heads. It may seem strange that bending dies for work of this nature can be made of wood, but they actually seem to work out better than metal as they reduce to some extent the peening action which tends to distort the metal being worked.

Some time ago there were published in the *American Machinist* descriptions of several remarkable drawing dies constructed of wood, which were employed in the manufacture of fenders and other parts of automobile construction. Many shops, however, do not have large-scale production work of this kind and might hesitate to believe that wooden dies would stand up for heavy work of a jobbing nature. My experience with these tools leads me to believe that others can follow with advantage the same system for the profitable production of other classes of work, and I am certain that there are many other shops that will find it a great convenience to be able to roll up large steel plates or sheets, as outlined above without having a set of rolls available.

The requirement grew out of the construction of some large snowplow fronts with the well-known curved shear plates for throwing the snow from the tracks. These plates were 12 ft. in length, with a width of 4 ft., being curved for about half of their width in a conical shape, with the point at the forward end. When they were built only at rare intervals a blacksmith and helper with sledge and fuller could shape one of the plates cold in a little over a day; but this would be far too slow for quantity production.

The device shown in Fig. 1 was designed and built for use on one of the structural-shop punch presses. The upper holder *A* was made of cast iron and serves to carry the wooden parts below. The cast-iron "knee" part *B* was made because no such part was furnished for this press.

The three blocks *C*, *D*, *E* are of hard maple, *C* and *E* being about 17 in. in length while *D* is 9 in. long. It will be seen that the punch *D* is fitted to the holding block *E* with an inclined rabbet, so that when the punch is moved from one end to the other of the holding block it will be raised or lowered through a distance of about ½ in. This affords an opportunity to adjust the block for different thicknesses of sheet, and also, by the same means, the pressure upon the work may be increased or diminished and a greater or less radius of bend be produced accordingly.

Since the sheet steel will be bent cold there will always be some spring to the metal, therefore the radius of the working face of the upper and lower blocks must be somewhat less than the actual radius desired in the sheet. This radius on the working face of *D* can ordinarily be made about 25 per cent. less than the radius of bend required, though in exceptional cases where it is desired to use the block for the widest possible range it can be made even less, the limit being that

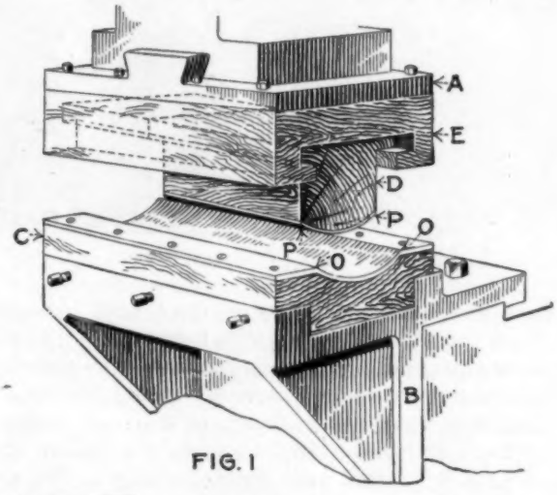


FIG. 1

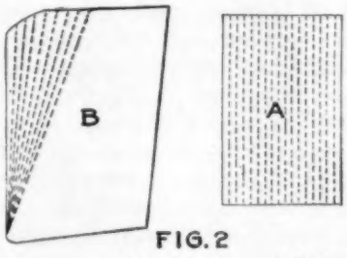


FIG. 2

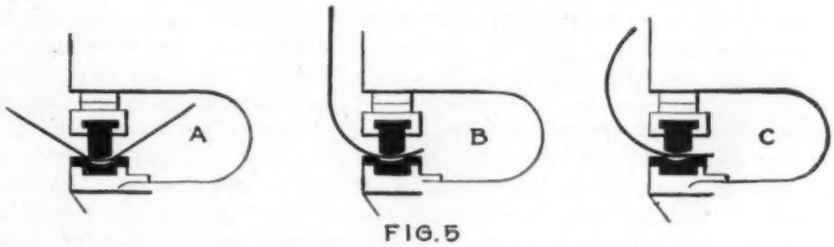


FIG. 5

FIGS. 1, 2 AND 5. FORMING SHEET STEEL WITH DIES OF WOOD
Fig. 1—Dies for forming curved sheets. Fig. 2—Chalk lines on the sheet. Fig. 5—Stages of operation shown in Fig. 4.

point where the block will no longer produce a smooth job, but a wavy, or bumpy, one.

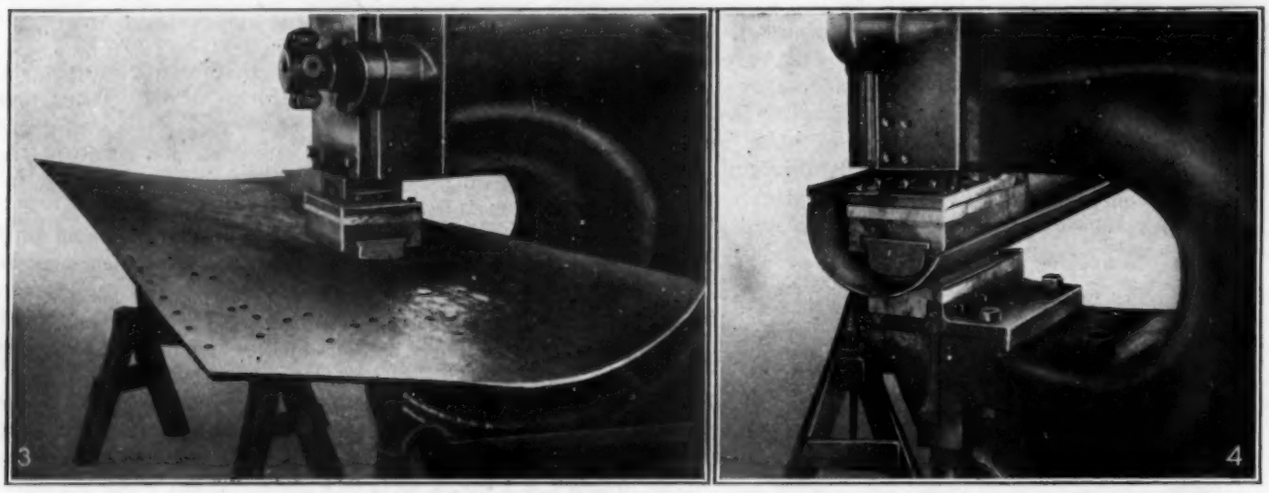
The radius of the working face of the block *C* should be somewhat greater than that of *D*, varying from 10 to 15 per cent. less than the radius of bend desired. Likewise the distance *O*, *O* should be about 25 per cent. greater than the corresponding distance *P*, *P* of the upper block. This will give the bending block a greater purchase on the work and augment the force of the blow, involving less strain on the press.

It will be observed in the illustration that the working surfaces of both the wood blocks are faced with sheet steel (about $\frac{3}{16}$ in. thick) held in place by wood screws along its outer edges. This steel facing would be unnecessary in ordinary work, it being put on originally when we had some heavy plates to bend that were rather rough and pitted with rust, as it was feared they might roughen the face of the blocks. The steel face also affords protection if the metal is to be bent hot.

When starting a bending operation with this device the sheet of steel is first laid out with parallel chalk lines on its inner face, as illustrated at *A*, Fig. 2, if the sheet is to have the same curvature throughout. For a sheet to be bent cone shaped, like the snowplow front plate at *B*, the chalk lines will spread out fanlike from the apex, as shown. The idea is that the sheet must be passed through the machine, successively following these chalk lines, otherwise it will become twisted and out of line with the bending dies, resulting in a badly distorted piece of work. With small plates, of course, this precaution is unnecessary if care is exercised in passing them through the dies. While advancing the work through the dies it is better not to attempt to push it forward the full length of the upper die at each stroke; half of this length at each advance will give better results.

The operation of bending the flared plate for the snowplow is shown with the work in the dies in Fig. 3, the operation being at this point about half completed. The finishing of these heavy plates to conform to the desired radius, including any truing and straightening necessary, picking up with the hand crane and laying down when finished, required about 30 minutes each.

The bending of some semicircular pieces of $\frac{1}{2}$-in. sheet is illustrated in Fig. 4. In this operation the limit of capacity of the device is reached, it being impracticable to bend much over a half circle, as at this stage the curling edges of the sheet will interfere with the frame of the press. Even in this case one precaution that must be observed in order to successfully complete the operation is to work from the center outward toward the edges. This idea is illustrated in Fig. 5, which shows a series of three operations. The first operation *A* is the bending of the center of the sheet; at *B* the bending is being continued toward one edge while the flat side remains outside the press that it may not interfere with the frame. The sheet is then turned end for end, bringing the curved side out and the finishing operation performed as at *C*. A glance at the illustration will show that it would now be impossible to reach the center of the sheet with the dies.



FIGS. 3 AND 4. THE BENDING OPERATIONS

In slightly altered form these tools may be adapted to form grooves and recesses in light sheets. For this purpose the upper die block is replaced with one having a flat lower face, and a bottom die block, shown in Fig. 6, having a number of grooves of different widths, is provided. If it is desired to form the groove shown at *A* $\frac{1}{2}$ in. wide, measured on the outside of the curvature, the edge of the sheet is placed under the punch, as shown in the cut, and a round steel rod, the diameter of which equals the width of the groove in the die less twice the thickness of the sheet, is laid on top of the sheet parallel with and immediately above the groove in the die. In this case for a $\frac{1}{16}$-in. sheet and $\frac{1}{2}$-in. groove the rod diameter would be $\frac{7}{8}$ in. When the upper die descends the rod and sheet are pressed down into the groove in the lower die and a neat, smooth depression is produced.

By advancing the sheet gradually this operation may be carried out in a sheet of any length in the same manner that the bending operations above described are accomplished. Grooves of any reasonable degree of depth may be produced with the same dies by raising or lowering the upper block the requisite amount. Many sheet-metal shops have rolls for producing similar results, usually for the purpose of wiring the edge of the sheet; but few of these rolls have a throat depth of more than an inch or two, while with this device and

an average-sized punch press the groove may be produced in the center of practically any standard sheet.

Other varieties of beading for ornamental work may be produced in a similar manner and very cheaply by making the necessary die blocks as at *B* and *C*. Here at *B* a bead was produced around a punched hole with the tools shown, the rod in this case being bent into

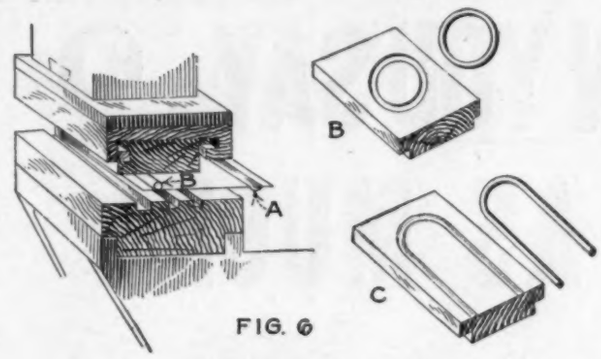


FIG. 6. OTHER USES FOR WOODEN DIES

a circular form to fit the die. At *C* the die and bent forming rod are for producing a large U-shaped bead.

With the necessary changes of the lower die blocks and the use of the proper intermediate working blocks it would appear that the opportunities were almost unlimited for making use of this method for small drawn parts of shallow depth not requiring great accuracy.

Woman in the Drafting Room

BY KATHERINE WORKS

Articles recently published in the *American Machinist* relative to the employment of women in the mechanical industries have been of great interest. The increasing employment of women in a great variety of mechanical work proves conclusively that the general opinion that women have no inborn mechanical interest is not founded on fact. It is simply a matter of education.

There is one kind of mechanical work for which women are particularly fitted that has not received much consideration, and that is making tracings. It is essentially work for women and they excel at it, and it is with the hope that I may bring the matter to the attention of employers that I write this communication. It may be noted that the viewpoint is that of a woman employee, while the majority of recent literature on woman's employment in the mechanical industries seems to reflect the man's point of view.

In our plant 20 of the 50 employees of the engineering department are girls, and some have been employed for several years. A girl having a high-school education and who writes a neat hand can become a proficient tracer in from three to six months. She may be considered a failure if at the end of that time her work does not compare favorably with the work of a boy of similar age and education with a full year's experience. This statement has been repeatedly made by our chief.

In our office the attempt is being made to develop draftswomen who will be able to do practically any of the work heretofore assigned to what might be called the junior draftsmen; that is to say women are being used to make the drawings for the application of electrical motors of various sizes and types to power-pumping machinery. Already a number of us can make the necessary general layout and can figure the ratios, pitch, face and diameters of gears to transmit the required horsepower. We make up the general arrangement drawings and the foundation. This work is of course thoroughly standardized. Formulas and tables are used in the determination of all gear sizes and strengths.

The limit of development as a draftswoman is hard to foresee, as it is simply a matter of interest. If one can develop an interest in mechanical things, will look at the pictures and read technical magazines and will think of her work rather than the things that usually occupy a girl's attention during leisure hours she can undoubtedly become as good a designer as a man.

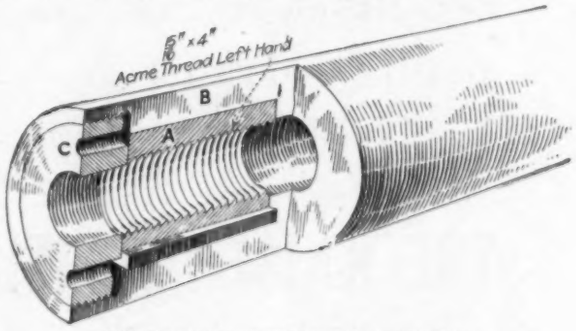
The method of employment in our office is to divide the force into squads. Under each squad leader one or more detailers and tracers are employed. The girls are first taught printing by having to make lists of material; they are then detailed to tracing in some squad and look to their squad leader for instruction. The effort is to have him develop them into detailers and to the point where they can handle complete orders themselves under the supervision of the squad leader. We are making progress in this connection.

In the selection of girls for drawing-room work employers may find some assistance in the following suggestions: To make a neat tracing a girl must herself be neat; she should be able to write a well-formed, rapid hand, uniform in slant and height; girls of a high-school education or its equivalent are perhaps preferable to those of higher education, as a high-school girl harbors no illusions as to the value of her services and consequently is more willing to start at the beginning and is not so readily discouraged when time passes without rapid progress.

Quick Repair for Tail Spindle of Lathe

BY PHILIP J. RAAB

The sketch shows a quick-repair nut for the tail spindle of a lathe. I have charge of a number of lathes and cannot have them down very long for repairs, therefore

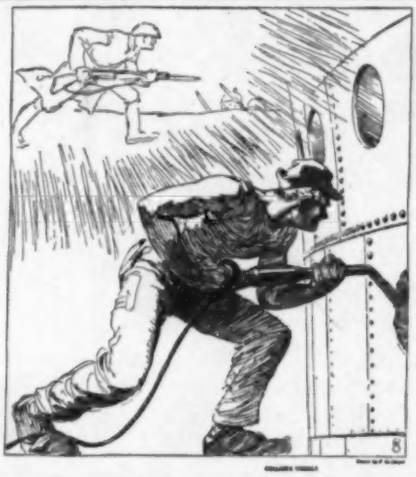


QUICK REPAIR FOR TAIL SPINDLE

I keep three of these nuts in stock at all times and a repair is made in 10 minutes.

Part *A* fits into part *B* and part *C* screws into part *B* against part *A*. A key in part *B* prevents part *A* from turning, and part *C* has a flat ground on it to let part *B* pass over the key that is in the tailstock. The reason for this flat is that the keyway in part *B* breaks through into the threaded hole.

Shop Placards (22x28 In.) Used by the Standard Parts Co., Cleveland, Ohio



"I Am With You Boy!"

CAN YOU SAY AS MUCH?

Your Employment Record will show the Answer. Perhaps you don't realize the Total Time you have been Out.

Ask Mr. Loose—he knows.

This Plant has____Day Employees and____Night Employees

	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
Absent Day						
Absent Night						

An American Soldier captured three Huns single-handed.

That is a FIGHTING record he can be PROUD of.

An American workman put in 100 per cent full time for fifty straight weeks.

That is a PRODUCTION record and he can be PROUD OF IT, TOO.

Neither one alone will win the war.
With both TOGETHER

THE KAISER'S FINISH COMES NEXT YEAR

Are You GAME?

This Plant has____Day Employees and____Night Employees

	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
Absent Day . . .						
Absent Night . .						

Sheet-Metal Work

By E. ANDREWS

ON PAGE 484, Vol. 48, of the *American Machinist*, H. H. Armstrong introduces a subject upon which a few notes from one who has been engaged in the art of working sheet metals for some years past might be of interest.

With the improvement of the quality of metals and the extension of methods of working them the sheet-metal industry has grown to be an important one. Never has rapid production in this trade been so necessary as at present, and when we observe the diverse things now made from sheet metal that within our memory were made of wood, stoneware, castings, forgings, etc., we discern the magnitude of its development.

Manufacturers of pressed sheet-metal work look to their tool and die makers to design and make tools that will insure rapid production with a minimum amount of scrap, which latter has become of vital importance by reason of high prices and scarcity of material.

In making dies for drawn work the problem of finding the proper blank dimension is important. There are several methods by which this may be determined. One is to multiply the circumference of the shell by its height and add the area of the bottom, then find the diameter of a circle of equal area; the other is to cut out a blank of the same gage of stock as the shell and then keep reducing its diameter until the blank balances the shell.

Designing Dies for Various Purposes

For many classes of work the blank diameter should be ascertained by experiment, as much depends on the ductility and thickness of the stock used. In designing dies for various purposes, the choice of which part should be the upper and which the lower one in the press depends entirely on which arrangement produces the easiest and quickest removal of finished product and scrap.

More interest would be taken in sheet-metal work generally and more doubtless written about it but for the fact that it lies rather outside the beaten path of engineering and that it does not appeal so much to the imagination as do some other branches. The working of sheet metals offers a wide field for experiment, as most sheet metals are capable of being forced, cajoled and worked into all conceivable forms and shapes by various methods.

Some idea of the output of modern sheet-metal-working machinery may be gained from the following: An automatic press is capable of producing cupronickel cups for bullet envelopes at the rate of 520 per minute. Another press is capable of cutting strips of hard-rolled steel $\frac{3}{32}$ in. thick into washers at the rate of 500 per minute. Another press will produce a motor-car radiator casing at one stroke in 12 sec. An automatic double-seaming machine will double-seam the top and bottom of square and irregular shaped sheet-metal boxes at the rate of 5000 per day. An automatic inclined press will produce 360 gross of circular sheet-metal stampings per day, and furthermore it is possible for one employee to attend to two or three machines. An automatic body-flanging machine will flange two ends of a canister at once at the rate of 60 cans per minute. It is naturally an unprofitable investment to equip a manufacturing establishment with all the latest and most approved facilities for press work if only small quantities are required.

In the operation of shaping and bending sheet steel it is essential to have the bends and breaks made across and not with the grain of the metal. For example, although copper is a highly malleable and ductile metal, many times copper sheets will be of abnormal hardness, and despite the most careful annealing will never reach the normal state of ductility.

Bending the Material

Bending such material at right angles without fracturing it is often impossible. Sheet metals of this character should be used only on cylindrical work or where a rounding bend is permissible in order to minimize the possibility of cracking.

When ordering sheet metals it is necessary to state the temper desired, whether hard or soft; also the surface finish desired, whether dead flat, open, annealed, planished or tinned. Care should be exercised also to specify the sizes of sheets best adapted to the purpose for which they are to be used.

In ordinary practice the majority of bends can be readily secured with any of the following sheet metals, providing the right temper is obtained: aluminum, brass, copper, iron, steel, tin plate and zinc. There are a few well-defined rules applicable to all shapes and sizes, which if carefully followed out will result in a first-class product with the metal unimpaired.

The majority of sheet metals possess the property of flowing; that is, the thickness of the metal can to a large extent be retained and the particles worked to different positions, or, in other words, the molecules be rearranged.

The Substitution of Sheet Steel

With regard to the substitution of sheet steel for the more expensive nonferrous metals it is obvious from the standpoint of national economy that it should be done wherever possible. Airplane and automobile manufacturers can save time, trouble and expense by using steel stampings in place of castings and forgings, as they eliminate the cost of machinery, are lighter, stronger and more uniform. Also, in motor-car and railway-vehicle construction the use of sheet steel for paneling, moldings, tanks, dashboards, underguards, etc., is specially advantageous. It gives the designer greater scope, as contours can be formed which it would be impracticable to carry out in wood, and furthermore sheet-steel parts can be used at once without having to wait for the material to be seasoned, while the subsequent behavior of the metal can be relied on whatever the climatic condition.

Large sheets without blemish are also obtained in steel, a matter which becomes daily more difficult in certain classes of wood used for paneling. As an illus-

tration, I have recently used some steel sheets having a surface area of 112 sq.ft., namely, 20 ft. by 5 ft. 7½ in., $\frac{1}{16}$ in. thick. If necessary, sheet-steel panels, etc., can be readily joined by the oxyacetylene-welding process.

It is of primary importance to obtain the best results with sheet steel, therefore the surface of the metal must be properly protected from atmospheric influences. Corrosion is its greatest enemy, and to prevent it the surface of the metal must be coated with a substance which should be comparatively inexpensive and readily applied.

Two Ways of Rustproofing

Commercially speaking, there are two ways of accomplishing this, which might be called respectively the metallic and nonmetallic methods. In the nonmetallic method the metal surfaces are coated with an organic substance, usually paint.

The essential of a good paint is that it shall adhere firmly to the surface over which it is spread and not chip or peel off. It must be noncorrosive to the material it is used to protect as well as to itself over long periods of exposure to atmospheric conditions; it must form a surface hard enough to resist frictional influences, yet elastic enough to conform to all changes of temperature or with a coefficient of elasticity approximately as near the material as possible.

The metallic method consists in coating the steel surface with some other metal. Aluminum, copper, lead, nickel and zinc have been used for the purpose. Zinc appears to most closely fulfill all requirements. There are various processes for coating steel surfaces with zinc; namely, electrogalvanizing, hot galvanizing and dry galvanizing, or sherardizing.

Steel Work Should Be Clean

By the first method the steel work to be treated is first thoroughly cleaned of scale, rust and grease, either by sandblasting or acid pickling, then placed as cathodes in a solution of some salt of zinc, usually the sulphate, and an electric current of low voltage passed through the arrangement. Hot galvanizing consists of dipping the metal into a bath of molten zinc at temperatures ranging from 750 to 850 deg. F. The work must be first cleaned as for electrogalvanizing, but a slight falling short of perfection does not have such disastrous effects on the quality of the work.

It has been found in practice that double-coated steel sheets are generally from two to three times more resistant to corrosion than single-coated sheets. The second coating fills the shrinkage cracks and pores in the first coat. In the hot-galvanizing process the steel sheets usually have an attractive spangled appearance.

Dry galvanizing, or sherardizing, is a modern process by which a deposit of a thin coating of zinc is made on the metal to be coated. Briefly, the process consists in sealing the work to be sherardized in metal retorts in conjunction with metallic-zinc dust. The retorts are then heated until the work has reached a temperature of from 500 to 700 deg. F., depending upon its nature. After several hours, the time depending on the thickness of the coating desired, the receptacles are taken from the furnace and allowed to cool.

Analyzing the items which go to make up the cost of sherardizing, it is found that there is a considerable saving over both the hot galvanizing and the electrogalvanizing; furthermore the coating adheres more firmly, and the metal is not weakened as is the case when light sheet steel is subjected to the process of hot galvanizing.

Sherardizing thus fulfills the requirements: That the coating is absolutely adherent, ductile and not liable to flake or peel off; that it is not porous, so that the metal is entirely protected. Moreover a sherardized coat of ½ oz. to the square foot affords protection equal to a hot galvanized coating of 1½ oz. to the square foot.

Sherardizing, like other zinc-coating processes, should have a clean surface to work upon, scale, rust or dirt greatly interfering with the sherardizing action. Steel articles coated with copper and then with nickel have excellent corrosion-resisting qualities, the resistivity increasing with the quantity of nickel deposited. This process is more expensive than sherardizing, but like sherardized articles it forms an ideal coating for sheet-metal work. It will not only withstand corrosion but also the strain of shaping and bending without fracturing. Time and weather tests have also demonstrated the durability and remarkable resistance to corrosion of copper-clad steel sheets.

Cobalt on Steel Articles

Cobalt is now deposited on steel articles under conditions identical with those met with in general nickel plating, being firm, adherent, hard and uniform. A smaller weight of cobalt deposit will give the same protective coating as a greater weight of nickel.

In making steel alloys the additions of chromium, vanadium, manganese, copper and tungsten in varying percentages give remarkable resistance to atmospheric corrosion. As an illustration, a "stainless" or "rustless" steel containing 10 or 12 per cent. of chromium and 0.3 to 0.4 per cent. of carbon has during recent years been used in the manufacture of table cutlery, as it is found not to corrode or tarnish in contact with food or acids.

I have mentioned but a very small percentage of the practical applications of sheet metal. It is but natural, when sheet-metal products are easily obtainable, are interchangeable, strong, light and highly finished, and furthermore represent great savings in time, wages and material, that their use should be extended.

Machine-Tool Outline Cards

By F. W. Salmon

I have just read the short article on page 52 of the *American Machinist* asking for plan-outline templets of machine tools, etc., for the use of purchasers and engineers in laying out plants to a scale of 1/48; that is, ¼ in. to a foot.

A few years ago, while engineer of an engine and boiler works, I had a number of such templets of the more common sizes of engines and boilers printed on transparent celluloid for free distribution to purchasers, mill engineers, architects and others likely to need them. Being transparent and reversible were two important features. These were the best and most useful things of that kind that I know of and may be of interest to your readers.

A Western Railroad Repair Shop

By FRANK A. STANLEY

Interesting bits picked up in a Far West railroad shop showing methods of aligning cross-head guides, renewing driving boxes, etc., "home-made" tools for handling work in the smith shop, and also illustrating a type of railroad passenger vehicle unknown (in this guise) in the East.

THE illustrations in this article are reproduced from photographs recently taken in the Reno repair shops of the Nevada, California & Oregon Railway, which extends from western Nevada, up through northeastern California and into the Crater Lake district of Oregon. While the shops referred to and illustrated herewith are not extensive in the usual sense of the word there is always something of interest to be seen in the various classes of work passing through them, a feature common to the majority of repair shops where everything that comes along must be treated practically as a special undertaking for which few elaborate tools can be made, owing to the limited number of pieces going through at any one time.

In Fig. 1 is shown a locomotive of the 10-wheeler, or 4-6-0 class, over the shop pits, with the middle pair of drivers dropped and preparations under way for lining up the cross-head guides; this process is presented a little more distinctly in the close-up views, Figs. 2 and 3, where the guide is depicted attached at its front end to the cylinder casting, while the rear end is supported by a bracket. A bent rod of ⅜-in. stock is secured between the washer and nut on the end of the crankpin in the driving wheel, and this is set with its extended arm central with the driver axle, so that a fine thread or wire attached at the right angle bend may be passed through to the front end of the cylinder to serve as an aligning medium for the setting of the cross-head guide.

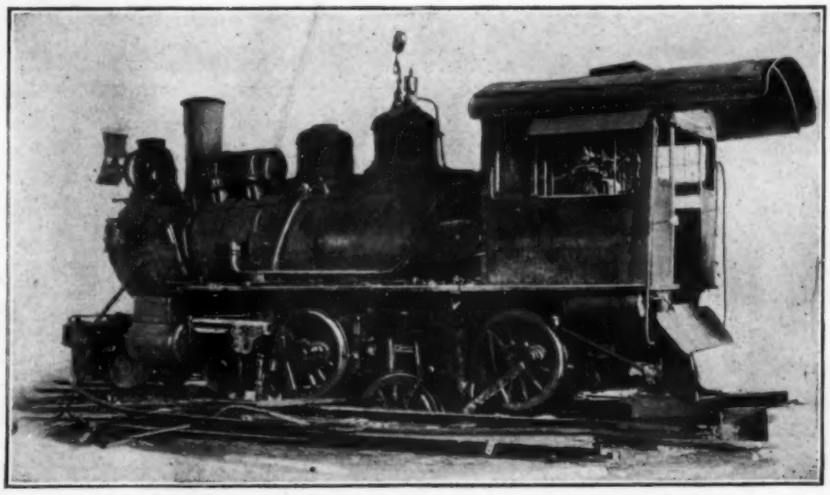


FIG. 1. ENGINE ON PIT FOR ALIGNING CROSS-HEAD GUIDES

At the front end of the cylinder a piece of wood bearing at its center a piece of tin, through which a tiny hole is pierced to receive the front end of the aligning thread, is inserted to fit snugly across the counterbore. This small hole is located at the center of the counterbore in the usual way by means of dividers or trammels. The thread, passing through the stuffing box at the rear end of the cylinder to the bent rod on the driving wheel, establishes an extension of the center line of the cylinder intersecting the center line of the main driving axle. As this line also passes through the cross-head it provides a point of departure for the adjustment of the cross-head guide until that member is parallel to the center line of the cylinder and at the right height throughout its length.

As driver boxes are overhauled in rather limited lots no attempt has been made to prepare expensive fixtures for handling them, but the work is facilitated by the aid of some simple and easily applied methods that should interest other shops that repair rolling stock on a moderate scale.

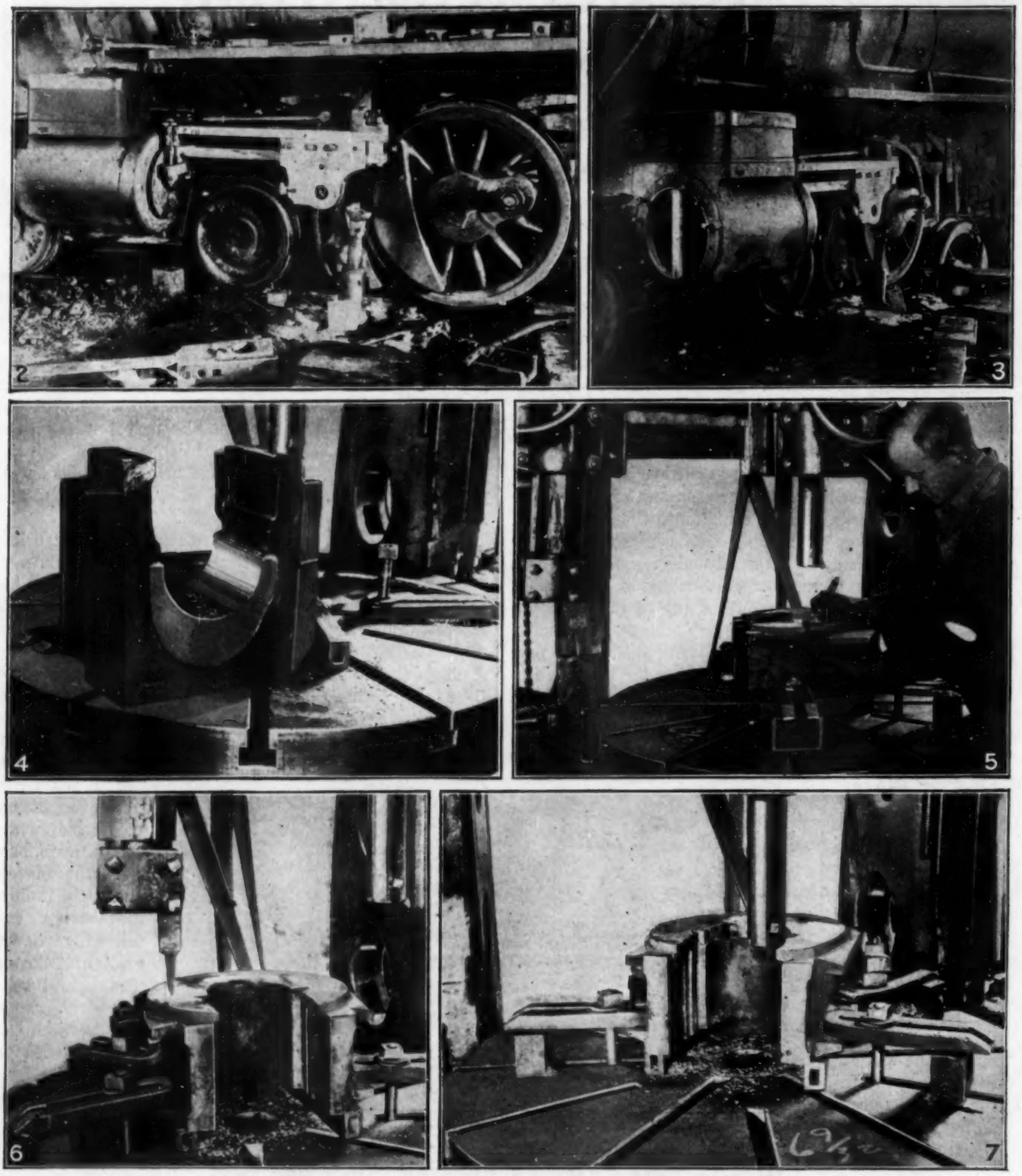
The driver boxes of the type illustrated in Figs. 4, 5, 6 and 7 have their brass bearing surfaces cast directly into the boxes, the appearance of the completed job being well brought out in Fig. 4, which shows a finished box standing on end on the table of the boring mill following the operation of boring. The lateral bearing surfaces, as will be seen, are integral with the bearing itself, the main box being formed with suitable anchor holes and slots to hold the brasses fast while being poured. In locating these boxes on the boring mill preparatory to clamping them for machining operations a simple templet, or gage, is brought into service for enabling the operator to set the box properly for the machining cut that is taken.

This particular size of box is for a 7-in. driving axle; but for other sizes the method of procedure is the same. It is desired, of course, to lay off the work and set it

on the table of the boring mill in position to bring the bearing central with the shoe-and-wedge bearing surfaces on the outside of the box; likewise to locate the center at the required distance from the end of the box.

of the body *B*, and is made or bent up from a piece of ⅜-in. stock 2 in. wide.

The loop is of sufficient width and depth to readily clear the flange along the edge of the box and rest

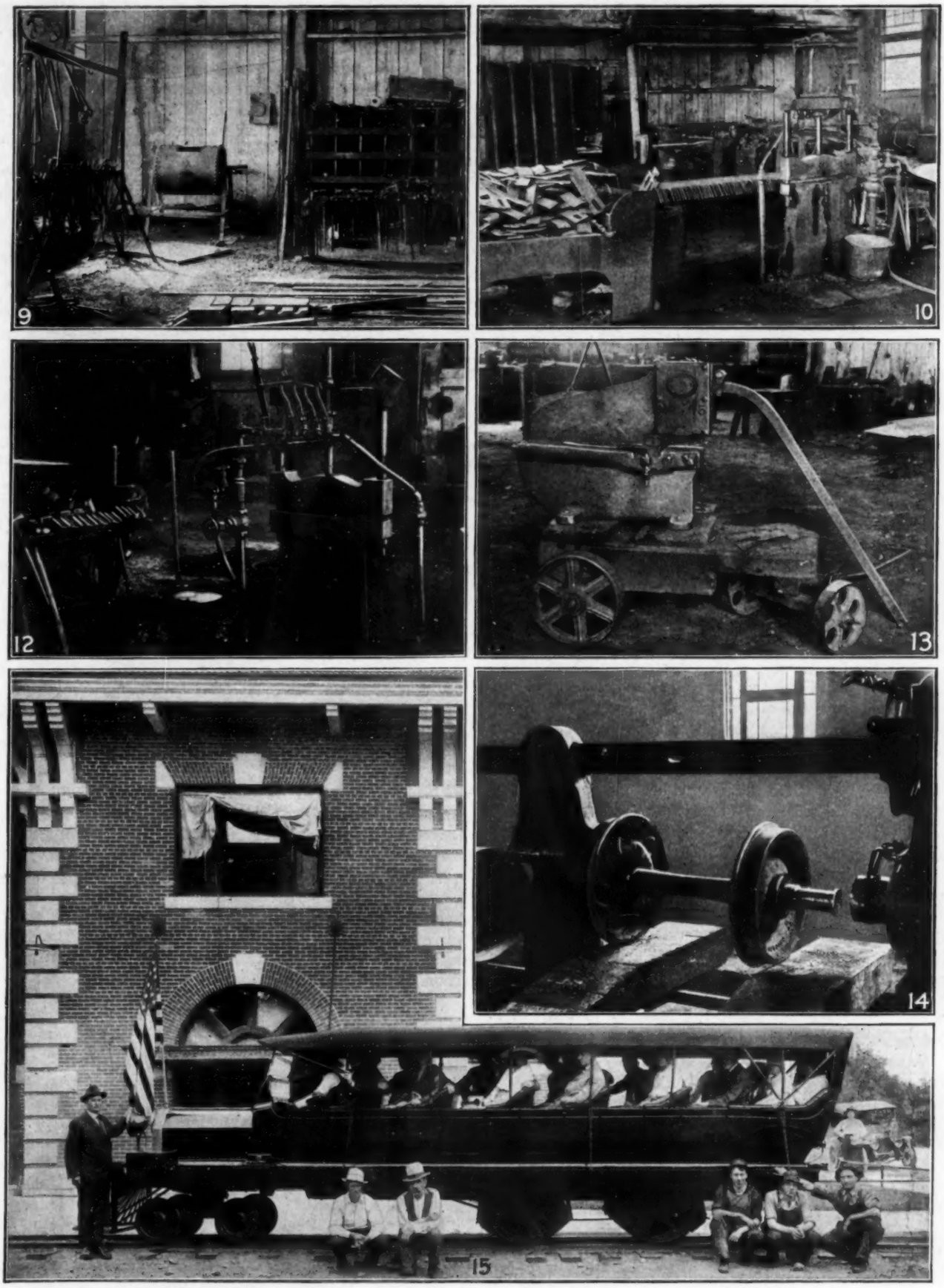


FIGS. 2 TO 7. A NUMBER OF THE OPERATIONS OR JOBS HANDLED

Fig. 2—How the line is held for setting the guides. Fig. 3—Method of centering the aligning thread at front end of cylinder. Fig. 4—A bored and finished driving axle brass. Fig. 5—Scribing the locating lines on the brass. Fig. 6—Setting the box by means of the locating lines. Fig. 7—Boring the brass to diameter

For laying out the lines to make this setting a small gage or scribing templet, like Fig. 8, is made, which is used as represented in Fig. 5. This templet, as will be gathered from examination of the sketch, Fig. 8, has its scribing edge *A* vertically in line with the vertical face

with its beveled edge on the upper face of the brass, so that a line may be scribed along the edge *A*. The templet is then placed on the other side of the box and a second line scribed for the opposite point. A third line at right angles to these two is located by placing a



FIGS. 9, 10, 12, 13, 14 and 15. VIEWS IN THE SHOP AND AN UNUSUAL VEHICLE

Fig. 9—Racks and holders in the blacksmith shop. Fig. 10—A home-made hydraulic press. Fig. 12—The controlling valves of the press. Fig. 13—Portable shear for general use. Fig. 14—How carwheels are rolled into the dismounting press. Fig. 15—An unusual type of railroad vehicle

straightedge across the open end of the box and measuring down the necessary distance. Thus when the box is positioned on the boring mill so that the three locating points come true under an indicator pointer carried in the tool head the job is properly set for the necessary boring operation.

The simplest indicator is an old file with a pointed tang gripped in the side of the boring-tool holder, as in

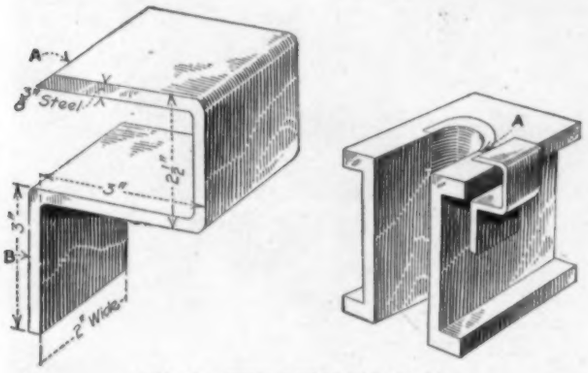


FIG. 8. THE SCRIBING GAGE

Fig. 6. With a few turns of the table and slight movements of the box upon its supporting parallels the job is set quite closely enough for the purpose (and that is very close too), for with the sharp point of the file tang brought into coincidence with the fine scribed lines on the work there can be little chance of error.

The boring cuts are taken with the tool shown in position in the bar, Fig. 7. Ordinarily but one tool point is used, although with a large number of boxes to bore at one time two single-pointed tools may be placed one above the other, with the upper one projecting a little further than the lower, thus dividing up the cut and allowing the work to be carried along more rapidly than with the single tool only.

With brasses of the diameter and style shown in the illustrations the work table is driven at 50 r.p.m for both roughing and finishing cuts, and a feed rate of about 0.012 in. per turn is used, three cuts being taken in all.

It is quite possible to maintain an appearance of order and neatness in the blacksmith shop as well as in other departments of a plant, but often, if we are to judge by the lack of order and the generally ill-kept equipment in some of them, there would seem to be little effort expended in this manner. This criticism, however, cannot be leveled at the forge shop here, for as depicted in Figs. 9 and 10 everything about the place is just where it belongs and in proper order when wanted.

A characteristic view is given in Fig. 9, which shows one corner of the shop with metal racks for every set of tongs, formers, swages, etc., in the department while in the rear is an orderly rack with compartments for bolts, spikes, etc.

Brass-Melting Machine

The cylindrical receptacle at the left center, mounted between A-shaped frames, is a brass melting machine made for use with oil fuel, the piping for air and ore being shown at the right-hand side.

The view in Fig. 10 is a reclaiming bench and rack where, under the hydraulic press seen at the right, old material, such as bolts, straps, brackets, etc., are put into shape for further use. Various kinds of bending and forming dies are used in this home-made press, and rounds as well as flats or squares may be shaped or reshaped as required. The sketches, Fig. 11, show some of the simple tools that are used.

The press is shown from the operating side in Fig. 12. Two of the handles are for the inlet valves, and two for the outlet. The four valve levers are connected at their upper ends to a longitudinal bar operated by the hand lever at the left of the cylinder.

The shear illustrated in Fig. 13 is made portable by mounting it upon a substantial truck with heavy axles

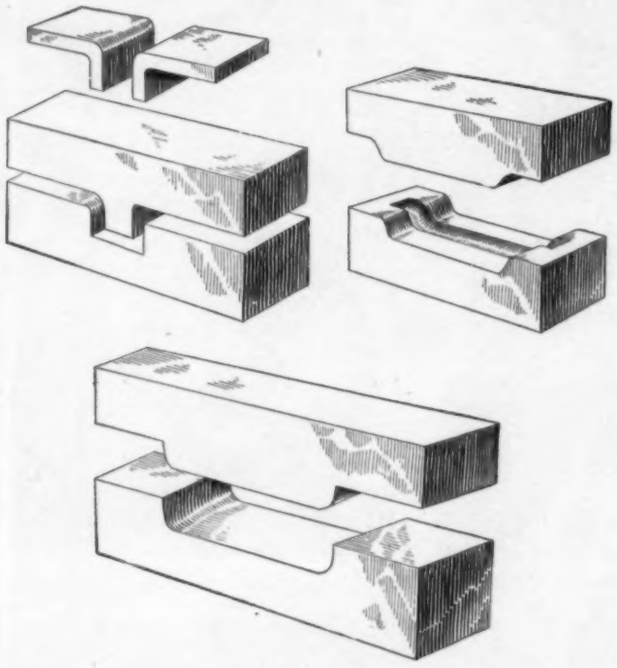


FIG. 11. SIMPLE FORMING DIES

and body to allow the machine to be drawn about the shops or yard and used wherever most convenient for the requisite work. While primarily devised for plate work around the boiler shop, round house and blacksmith shop, it is found to be useful at many other points.

When dismounting carwheels the work is brought into the wheel press at the desired height to reach the centers of the ram by the inclined ways shown in Fig. 14, where an axle and pair of wheels will be seen in position for dismounting.

A Railway Automobile

In Fig. 15 is shown an automobile adapted to railway operation. It is one of several recently rebuilt and placed on light passenger runs over the lines of this company, being originally a regular seven-passenger pleasure vehicle which was modified to conform to the new requirements by cutting the chassis in two, building in a new section to increase the length of the body for four additional seats, giving a total seating capacity for 25 persons. New wheels were placed underneath with heavy steel rims and standard flanges, and a four-wheel truck constructed for the front end.

The vehicle seems rather unusual when used in connection with railroad tracks but the body is a more or less familiar sight in some of the larger cities of this country where sight-seeing is prevalent.

Strut Sockets and Other Sheet-Metal Airplane Fittings

By FRED H. COLVIN

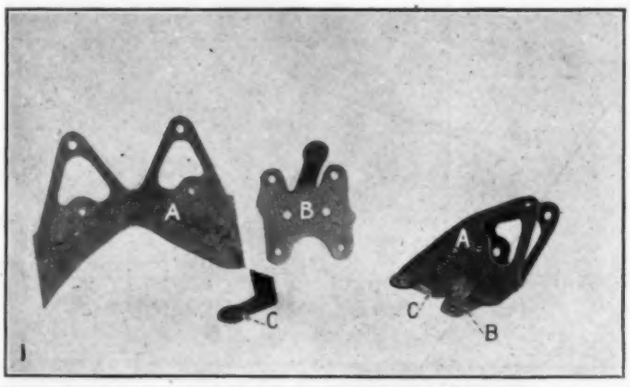
Airplanes require a large number of metal fittings entailing considerable machine work. Many of the fittings are built up of combinations of sheet-metal stampings or of forgings and stampings. The illustrations show in detail the operations on several complicated pieces.

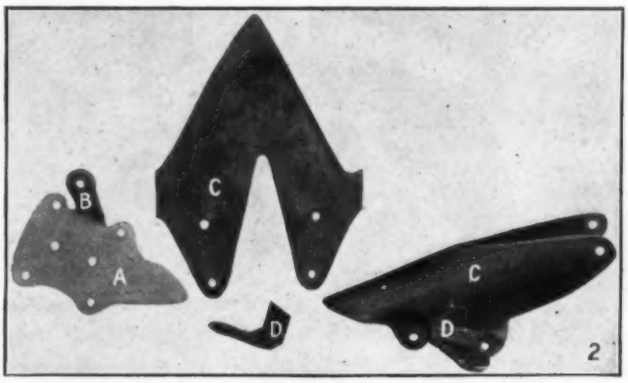
WE HAVE become so accustomed to thinking of the airplane, aside from the engine, as a combination of wooden parts fastened by some sort of unmechanical devices that we do not realize how largely metal and machine work now enter into its construction. Every joint is reinforced with metal in some way or other, and bolts, nuts, turnbuckles and fittings of various kinds make a very respectable total of metal, all of it machined.

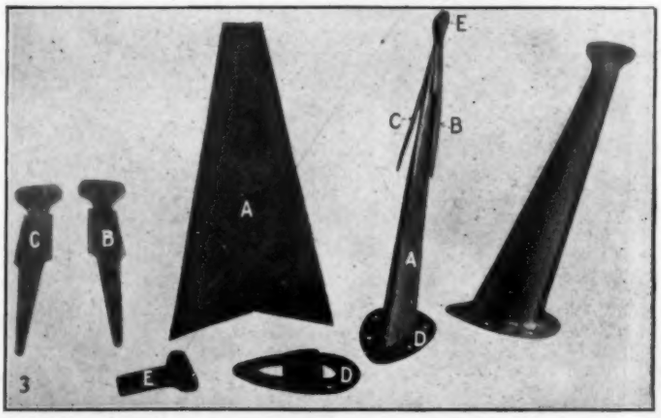
Some of these fittings are difficult to make, being built up of combinations of sheet-metal stampings or combinations of forgings and stampings. Many of them require very interesting dies, while others are cut out by punches or saws, folded up and welded, owing to the quantity not being large enough, as this is written, to warrant the expense of dies.

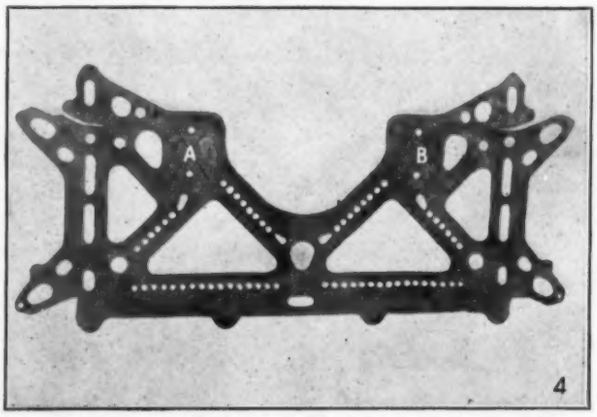
The illustrations show a few of the fittings and the way in which they are built up. Oxyacetylene is employed largely for welding the parts together, but this work is of course dependent on the skill of the operator; and as the safety of the aviator depends on each fitting doing its full duty this matter becomes a very serious problem. Some fittings are brazed after

FIG. 5. FORMING THE RADIATOR SUPPORT









FIGS. 1 TO 4. STRUT SOCKETS AND SUPPORTS FOR TRUSS WIRE AND RADIATOR

Fig. 1—Socket for front landing-gear strut. Fig. 2—Socket for rear strut. Fig. 3—Horn for truss-wire support. Fig. 4—First stage of radiator support

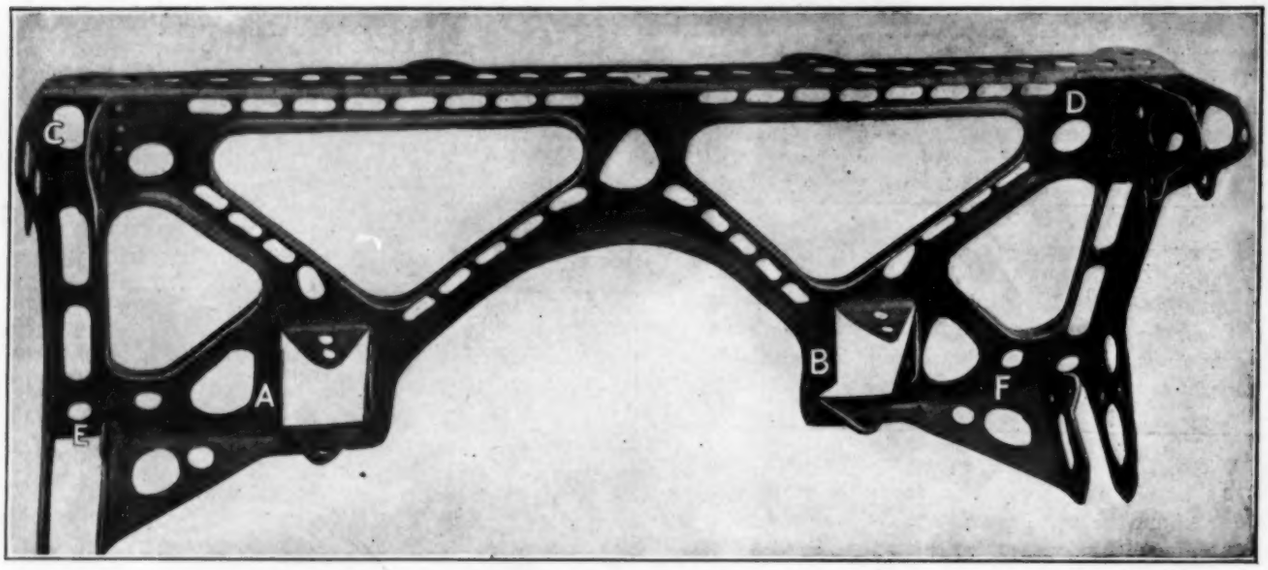


FIG. 6. THE FINISHED PIECE

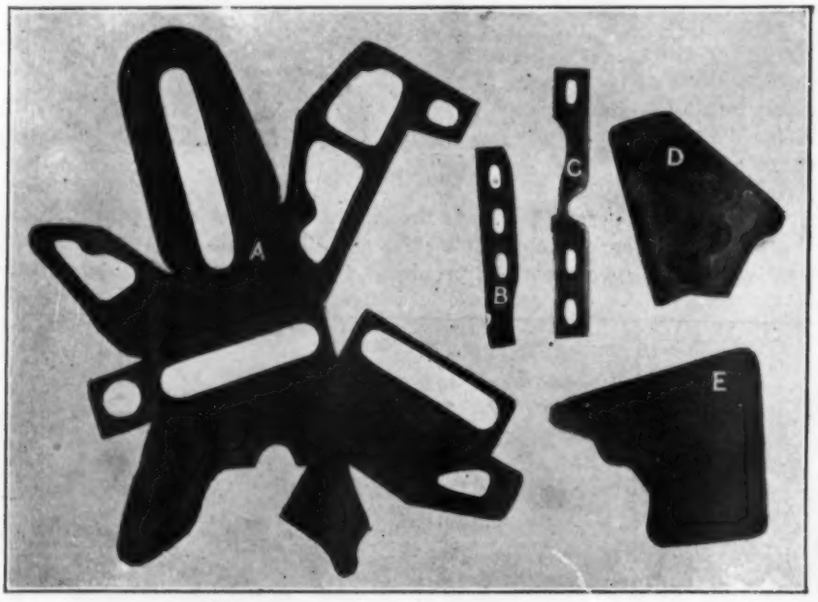


FIG. 7. ELEMENTS OF LANDING-GEAR SOCKET

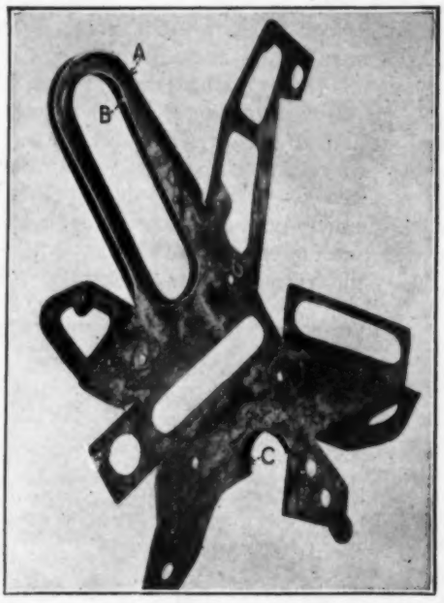
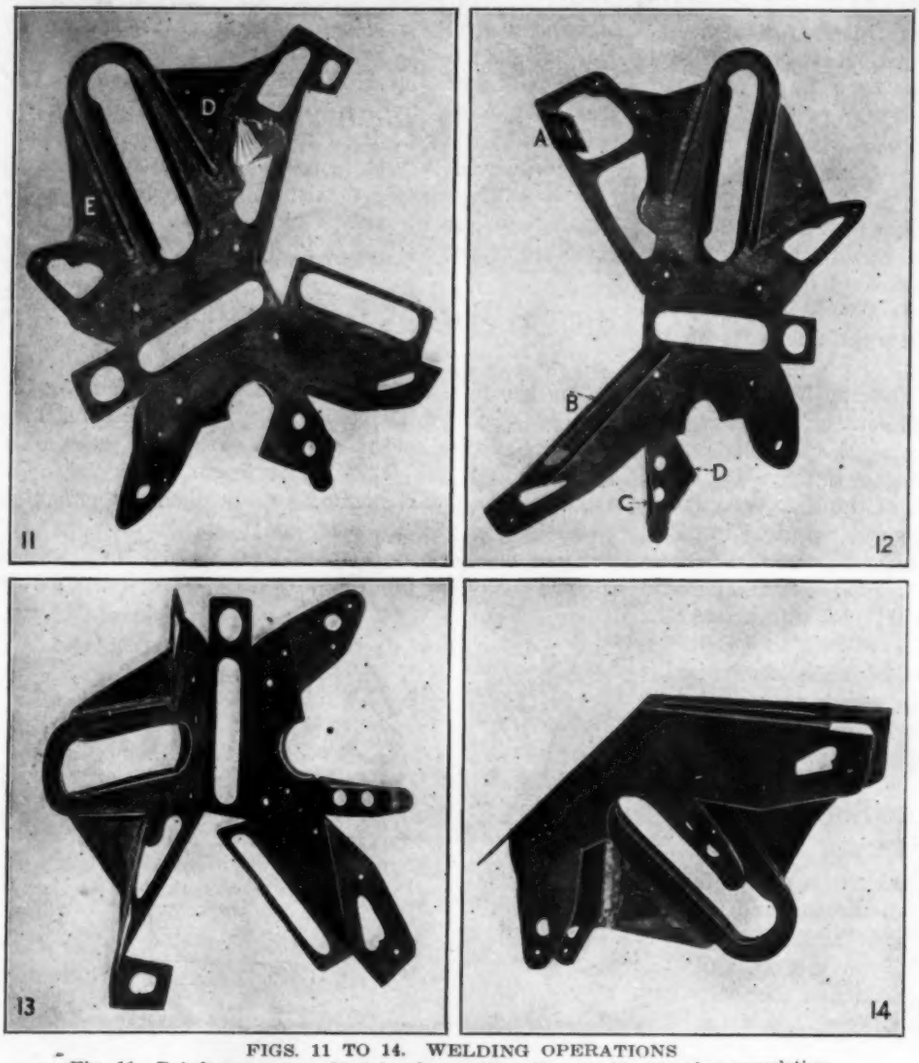


FIG. 8. AFTER FIRST OPERATION

FIGS. 9 AND 10. BENDING THE LARGE PIECE TO FORM

being fastened together, or "tacked," by means of the spot welder. The brazing is preferred by some, owing to the lessened danger of burning the metal. Where it is necessary to heat-treat the part, welding is the only method which can be used. Many of these fittings form a very interesting study of punch and die work and afford a good field for experts in this line.



FIGS. 11 TO 14. WELDING OPERATIONS
Fig. 11—Reinforcements welded in place. Figs. 12 and 13—Nearing completion. Fig. 14—The fitting complete

A socket for the front upper end of the landing-gear strut is shown in Fig. 1. It is built up of three pieces *A*, *B* and *C*. The larger piece *A* is bent to an oval form, and the lower edge is welded to the baseplate *B*, as can be seen. The side connection *C* is also welded in place, completing the strut socket.

The rear landing socket is illustrated in Fig. 2. It is somewhat similar to that in Fig. 1, but is longer and at a more acute angle. The pieces are lettered *A*, *B*, *C*, *D*. In this socket the baseplate has an ear on one side. The small ear *D*, Fig. 2, is welded on the other side, as shown, although the illustration shows it simply tacked in place ready for welding.

A more complicated piece, one of the horns that go on top of the wing, or aileron, is shown in Fig. 3. This consists of the main body *A*, the two top connecting pieces *B* and *C*, the base *D* and a reinforcing piece *E* that goes between *B* and *C*. These pieces are seen in preliminary assembly at the right of the main piece, and a completed horn at the extreme right. In the illustration the edges of the main piece are shown held together for welding by means of spot-welded points along the front edge. The reinforced piece *E* is welded between the reinforcements *B* and *C* so as to make the ends strong enough to stand the necessary stresses. A much larger piece, Fig. 4, is the nosepiece that goes at the front of the fuselage, tying it together very substantially and providing a firm support at the front end for the two pieces that support the engine. This illustration shows the piece as it comes from the slotting shear, which cuts not only the outside, but also the X-shaped openings *A* and *B*, which are afterward formed to support the engine-base strips. Fig. 5 shows the way in which the edges of the large opening are formed. The piece is clamped between two substantial frames by means of a C-clamp *A*, and the whole thing is held in a substantial vise. Then the edges of the triangular opening are formed over by means of a light sledge *B* in connection with the bar *C*, which is held by an assistant. A very good job results, but of course much more time is required than if dies were made for handling this work in a suitable press. Fig. 6 shows one of the completed frames. It will be noticed that the holes have been slotted through in pairs to reduce the weight of the piece, that angular ears have been bent out to receive the engine-base pieces at *A* and *B*, that auxiliary ears have been riveted on at *C* and *D* and that the angular portions have been welded at *E* and *F*. This piece is quite complicated, especially when built up in this way.

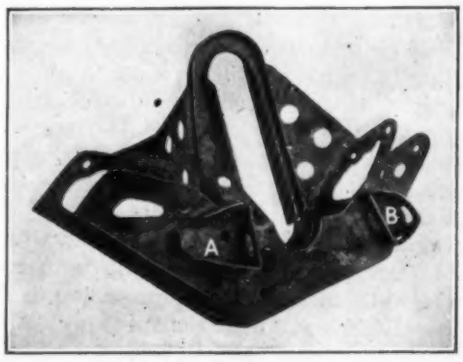


FIG. 15. REVERSE SIDE OF THE COMPLETE FITTING

The beginning of what is perhaps the most complicated piece to make on the whole machine is shown in Fig. 7. This is the lower strut connection for the landing gear, and it also carries the shock absorber and axle. As will be seen, it consists of five pieces, the main piece *A* and the reinforcements *B*, *C*, *D* and *E*. These are shown as they come from the press.

The next operations, Fig. 8, consist of forming over the edges *A*, *B* and *C*. This work is also done by hand instead of in a press, the method being similar to that employed in the larger piece previously illustrated. Then the piece is bent, as shown in Figs. 9 and 10, by clamping between plates and bending down to the form of the plate by means of the tool shown. Various shapes are secured in this way, and the piece is now ready for some of the reinforcements to be welded in place.

In Fig. 11 the pieces *D* and *E* may be seen welded in position, while Fig. 12 shows some of the ears bent up at *A*, *B*, *C* and *D*. Continuing the bending operations we have the piece as shown in Fig. 13, while Figs. 14 and 15 give two views of the completed structure with the various pieces welded in position. Fig. 15 shows the inside of this piece with the two sockets *A* and *B* welded in position to receive the cross-members of the landing gear, which hold the side struts the correct distance apart.

A careful study of this piece, which is known in the shop as the "peach basket," will readily show many opportunities for manufacturing it at a greatly reduced cost by the use of dies for bending it to shape.

Humor in the Shop

By James H. Follen

While much has been said and written with reference to the efficiency of the modern toolroom, and while it cannot be doubted that new tools and methods have greatly simplified and intensified production, still it is not to be denied that the qualifications of the toolmakers themselves as a class are below the standard of 10 or 15 years ago.

One reason for this deterioration is the influx, since the beginning of the present abnormal demand for skilled workers, of young fellows who, after a few weeks' or months' experience, having acquired just sufficient knowledge of a lathe to know on which side of it to stand, purchase a new and shiny toolbox and a white apron, and go to some shop where they are not known demanding "60 cents an hour to start."

Their ignorance of even the most ordinary jobs furnishes much amusement for the old-timers who have spent half of their lives in the shop. Even the "crabbiest" of the old boys will take an interest in an important newcomer who is trying to adjust his lathe to turn a taper by prying over the rear end with a crowbar or is carefully heating a shaft to a cherry red in the forge while the collar he is preparing to shrink on lies under the faucet to get the "proper chill."

Once when we were building a sample truck a young "toolmaker" from the shop for whom we were doing the work came in saying he had been sent over by the assemblers for the "wheelbase," as they wanted to use it. At another time on this same job a youth of about twenty years, with his eyes properly fitted with the latest style of "frames," dropped in to look over the job about which he apparently knew as little as the other fellow. He modestly admitted, however, that he was the "ranking engineer" on the job, which our "old Mac" said was probably true—being the "rankest engineer *he* ever saw."

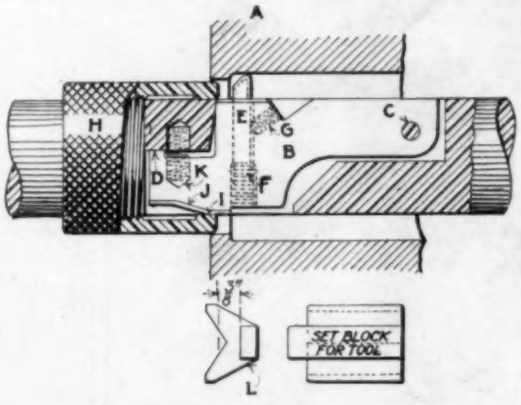
The old-timers, notwithstanding their propensity for practical joking, were a kindly, good-natured bunch, ready and willing to impart information or render assistance where it was honestly and properly desired, reserving those whose egotism and self-importance demanded some such corrective influence to be the butt of their ridicule.

A Bar for Boring a Chamber

By Osbert E. Charles

The bar here shown was designed for recessing the casting *A*, the work being done in a boring machine with the casting held in a special fixture. The diameter of the bored hole is 2⅜ in. at one end and 2½ in. at the other, with a chamber 2½ in. in diameter extending a distance of 6¼ in. between them.

The tool block *B* is fitted to a slot in the bar and swings upon the pin *C*. It bears upon a ledge within



BORING BAR FOR RECESSING

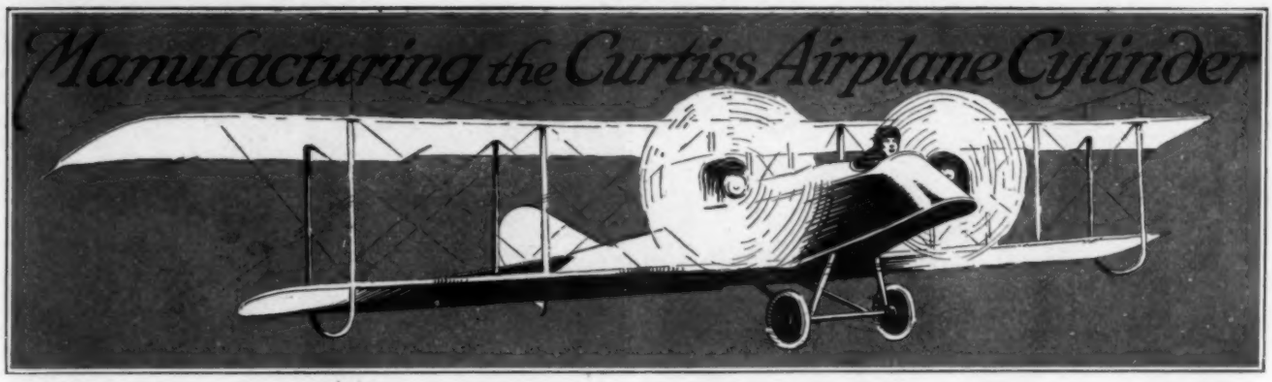
the slot at *D*, providing a solid locating stop which determines the diameter of the recess after the tool *E* has been properly set by means of the adjusting screws *F* and binding screw *G*.

The annular nut *H* bears upon the swinging tool block at *I*, at which point the surface of the block conforms to the radius of the bar.

As the nut is run back, the working point *I* travels down the inclined surface of the block at *J*, allowing the spring *K* to swing the block away from the bearing at *D*, thus moving the point of the cutting tool toward the center of the bar.

In operation the bar is run into the work to the point where the recessing is to commence, the machine is started and the operator grasps the knurled portion of the nut, holding it against the rotation of the bar. This causes the nut to advance along the bar, the bearing point *I* traveling up the inclined surface *J* of the tool block until the shoulder of the latter comes to rest against the ledge *D*, and the cutter is then in the correct position to bore the desired diameter.

A setting block by means of which the tool is properly set before putting the bar in the work is shown at *L*.



By G. D. RANGER
Factory Manager Standard Gauge Steel Co.

III. Final Operations

With the completion of the brazing operations the rest of the work is carried out on machine tools of one kind or another, and as there is always a possibility of a machine operation opening up the brazed joint between the jacket and the cylinder it frequently becomes necessary to test the tightness of the joint. The operations subsequent to brazing are fully covered in this the final article.

AFTER brazing, and while they are still hot, the cylinders are placed head down in lime boxes, Fig. 32, to prevent them from becoming hard through cooling too rapidly in the open atmosphere. When thoroughly cool the cylinders are taken from the lime boxes and the water inlet and outlet are drilled through the jacket. From here they go to the first water test, shown in Fig. 33. The inlet *A* is connected with the air-service pipe *B*, which is supplied with air at a pressure of 80 lb. per square inch. The test holes are plugged up with wooden plugs *C*. A cam-operated plug *D* is placed over the outlet *E*. When the air is turned on the operator passes a cloth wet with soap suds over the joints and any leaks are immediately disclosed.

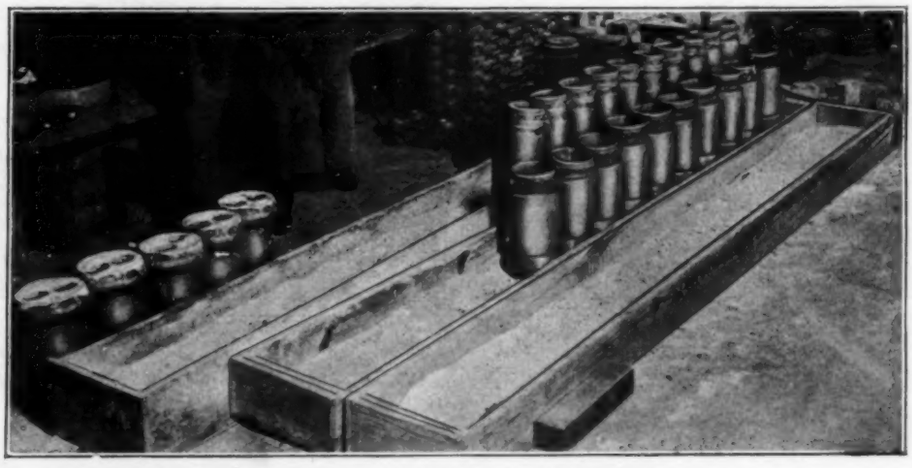
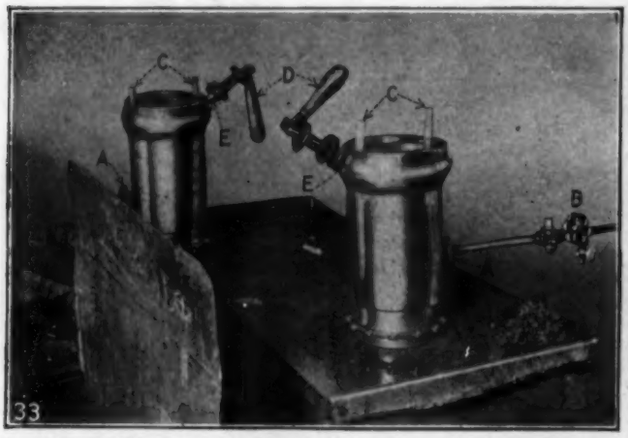


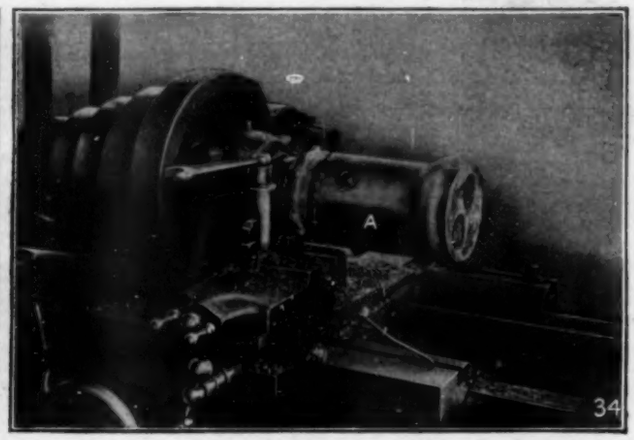
FIG. 32. CYLINDERS IN LINE BOXES

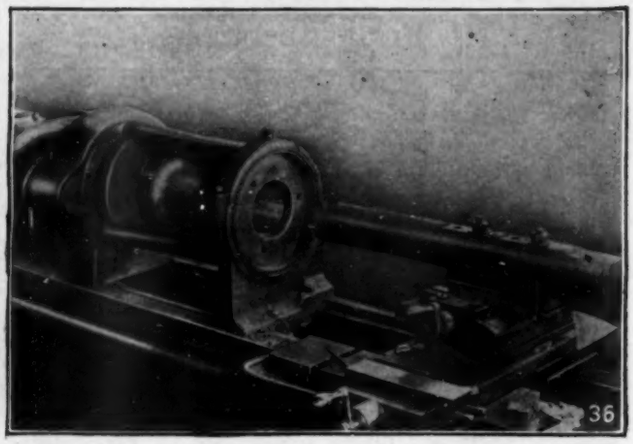
The pilot which locates the cylinder in the crank case is now rough-turned and the head faced off. This is done on an engine lathe, Fig. 34. The cylinder *A* is gripped on an expanding mandrel operated by a screw which passes through the center of the lathe spindle. After this operation the work is again subjected to the water test. If no leaks are discovered the jacket is now filed and finished by hand, as shown in Fig. 35. The wooden chucks *A* for holding the work while being filed are split longitudinally and opened by means of a wedge controlled by the lever *B*. The cylinder is now bored in a jig in the lathe to $4\frac{31}{32}$ in., Fig. 36. Pins in the jig engage the flange and a screw at the back forces the cylinder forward. It will be seen that the forward end of the jig runs in a steadyrest.

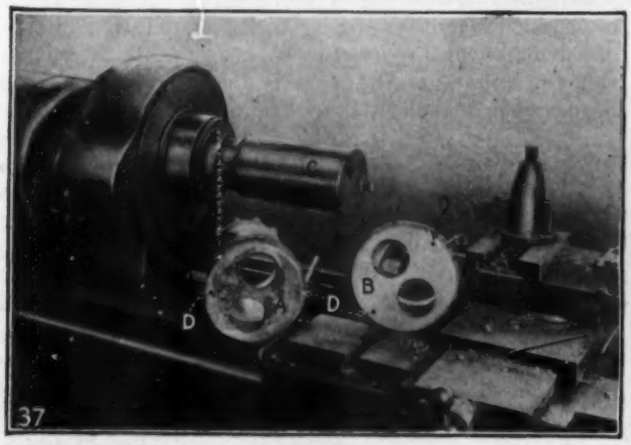
The next operation is facing the head, Fig. 37. This is performed on an engine lathe provided with an expanding mandrel. In this illustration the rough work is shown at *A* and the finished work at *B*, while the expanding mandrel *C* is exposed to view. The small holes *D*, two of which are in each cylinder head, are the test holes referred to as being plugged up for the water test. Their object is to permit measurements to be made from the cylinder head proper to the outside of the plate which covers the water space. In the operation the outside of the plate is faced $\frac{9}{16}$ in. from the head proper of the cylinder. The neck *A* of the cylinder *B*, Fig 38, is now turned to size. At *C* is the snap gage for the diameter, and at *D* the formed tool that determines the shape and width of the turned part. In this operation the work is held on an expanding mandrel. As this operation removes some metal from the lower part of the water jacket where it joins the cylinder another water test becomes necessary. There is no need, however, to detail this water test, as it is similar to the one already described. Having passed the water test the pilot is finish-turned, using the same mandrel as shown in Fig. 38.

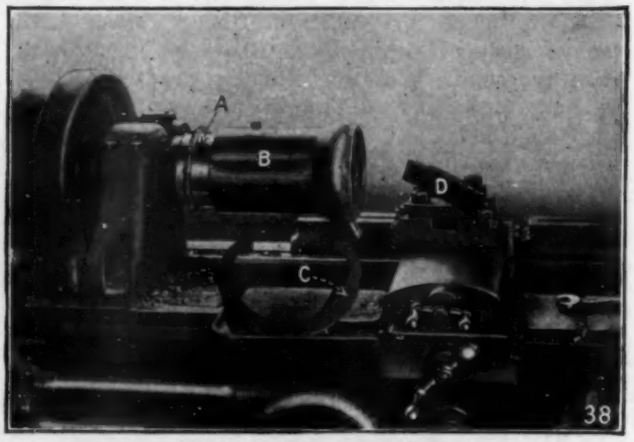
The valve ports are now finish-turned and reamed in the turret lathe shown in Fig. 39. The work *A* is mounted on an indexing fixture *B* with two stations, so that each of the ports in turn can be brought con-

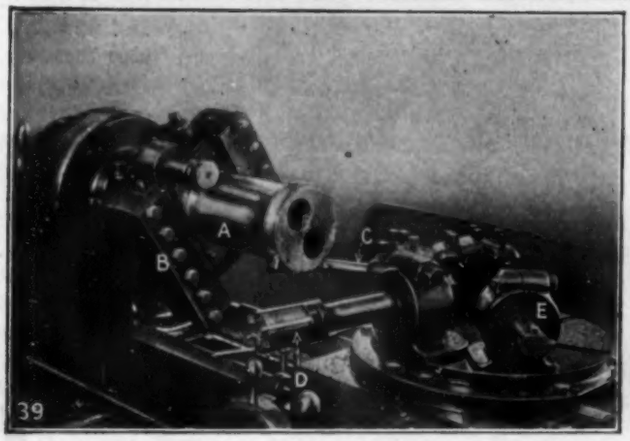


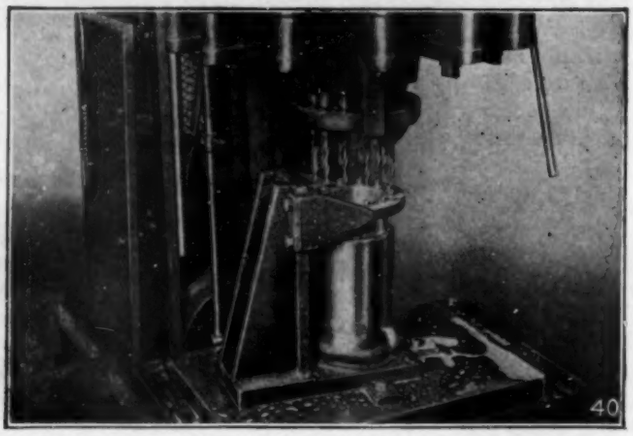






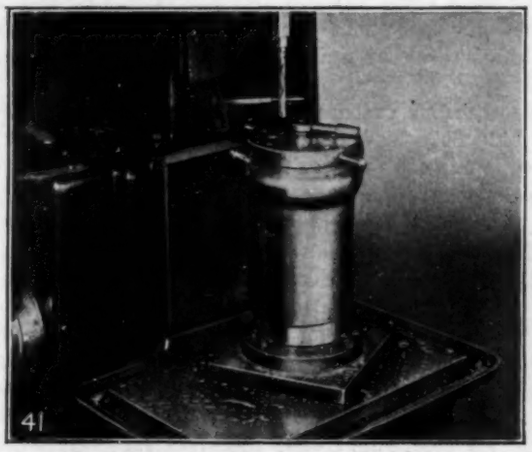


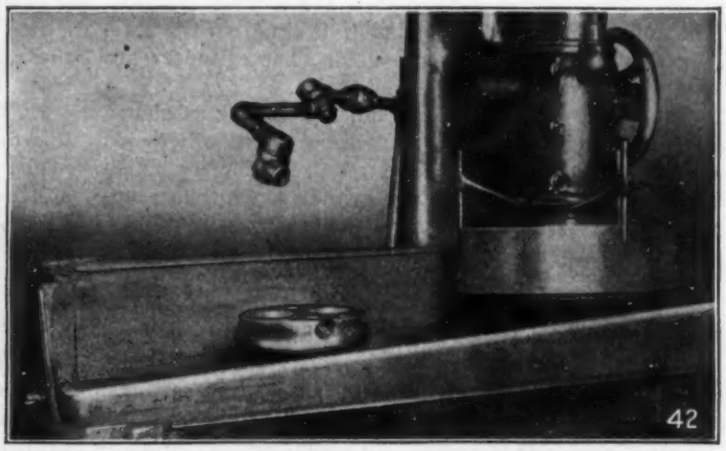


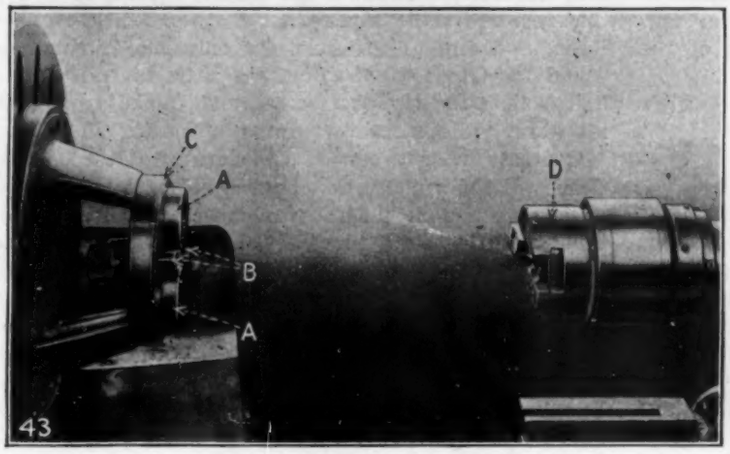


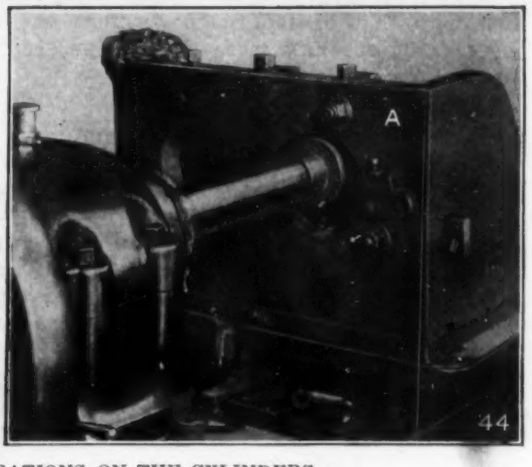
FIGS. 33 TO 40. A NUMBER OF OPERATIONS ON THE CYLINDERS

Fig. 33—Water test. Fig. 34—Rough-turn pilot and face head. Fig. 35—Finish jacket. Fig. 36—Finish-bore. Fig. 37—Finish-face head. Fig. 38—Turning neck. Fig. 39—Finish-bore and ream ports. Fig. 40—Drill anchor flange









FIGS. 41 TO 44. DRILLING AND GRINDING OPERATIONS ON THE CYLINDERS

Fig. 41—Drill spark-plug and gear holes. Fig. 42—Surface-grind head. Fig. 43—Finish counterbore. Fig. 44—Rough and finish grind

centric with the axis of the lathe. Three tools are used, *C D* and *E*, that is, boring, reaming and counterboring respectively. The tolerance on this job is 0.0015 in. The anchor flange is now drilled as in Fig. 40, the multiple head carrying 12 drills. The spark-plug holes and valve-mechanism holes are next drilled, Fig. 41, and tapped. The cylinders are placed head up on a magnetic chuck in a vertical surface grinder and the tops ground off to bring the cylinders to the specified height. The set-up for this is shown in Fig. 42.

The inside face of the head and the counterbore of the combustion chamber are finished with the set-up shown in Fig. 43. Here the work has been purposely left out so that the means of holding it can be properly shown. The two plugs *A* enter the valve openings, and the two screws *B*, which are tapped into the spark-plug holes, draw the head of the cylinder against the face *C*. The counterboring tool *D* is exactly the same as that shown in Fig. 21. This operation is followed by another water test similar to those already described.

FIG. 45. THE FINISHED CYLINDER

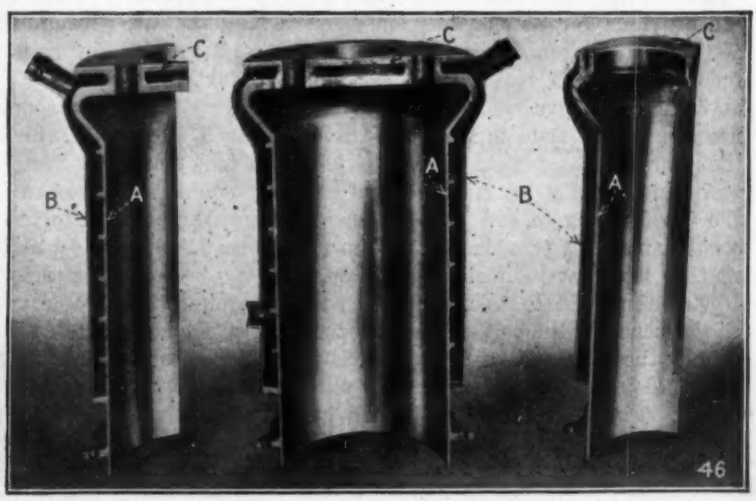


FIG. 46. SECTIONS OF FINISHED CYLINDER

The final operation of the cylinders is grinding the bore. For this Heald machines are used. The cylinders are first rough-ground 0.010 in. under size.

The set-up for rough and finish grinding is shown in Fig. 44. The cylinder is secured to the other side of the anchor plate *A*. The requirements for finish grinding are very close. The cylinders, which are approximately of 5-in. bore, must not be more than 0.001 in. out of round, and they must be within plus or minus 0.0005 in. of the specified size. The three views of the finished cylinder are shown in Fig. 45. The approximate size of the cylinder can be gained from the knowledge that the bore is about 5 in. In Fig. 46 is shown a cylinder which has been cut in sections. At *A* is the cylinder proper; at *B* the Monel metal jacket and at *C* the top plate. Comparing this illustration with that of the rough forgings one can now more easily see how more than 90 per cent. of the original forging is reduced to scrap.

Skill Then and Now

By Donald A. Hampson

A great deal has been said and written about the skill of the mechanics of the old days—an intangible something they possessed that has vanished so far as present-day mechanics are concerned and the loss of which we mourn. True it is that modern training in machine shops makes operators rather than all-around machinists, but the shops of today are turning out more all-around machinists than ever before, and these men are as skillful as those of yesterday, and perhaps more so. It is the great expansion and development of the metal trades in the last decade or two that has caused the dilution of the "body mechanical."

Manufactured Products

Any man will tell you that they "don't make the Fords as good as they used to"—this in face of the truth that they run more miles to a gallon of poor gasoline, ride easier, go farther and faster, are overloaded twice as much, and are expected to be (and are) on the road most of the time. It is the same spirit which prompts some men to condemn the workman of today. The machines he runs turn out five times the work they did in 1890, and all sorts of fixtures are provided for him to keep busy every minute. We don't see a machinist with a shaft to turn, and speeds, feeds and cutting tools that permit him to start a cut at 7 a.m. and have nothing to do but "shut her off" at noon by which time the cut has traveled only 5 ft. of the required 6. No, if he has a job with long cuts, and the capacity of machine and steel is such that the job is going to last half an hour or more, there is another machine provided for him to run, so that he has no time left to wander about the shop.

Question: Did it take skill to wander around the shop discussing the ball game or the long hours of labor? Is not the man who sets up and turns five pieces in a half day as skillful as he who once was considered a crackerjack who turned but one in the same time? No one denies that geared feeds and motor drives and high-speed steel have done a lot of this, but they are only means of bettering and shortening manual exertion—the machinist still has to place his work in the lathe, set his tools, measure his diameters, doing all these things to closer limits and in less time than his older brother who was really "skillful."

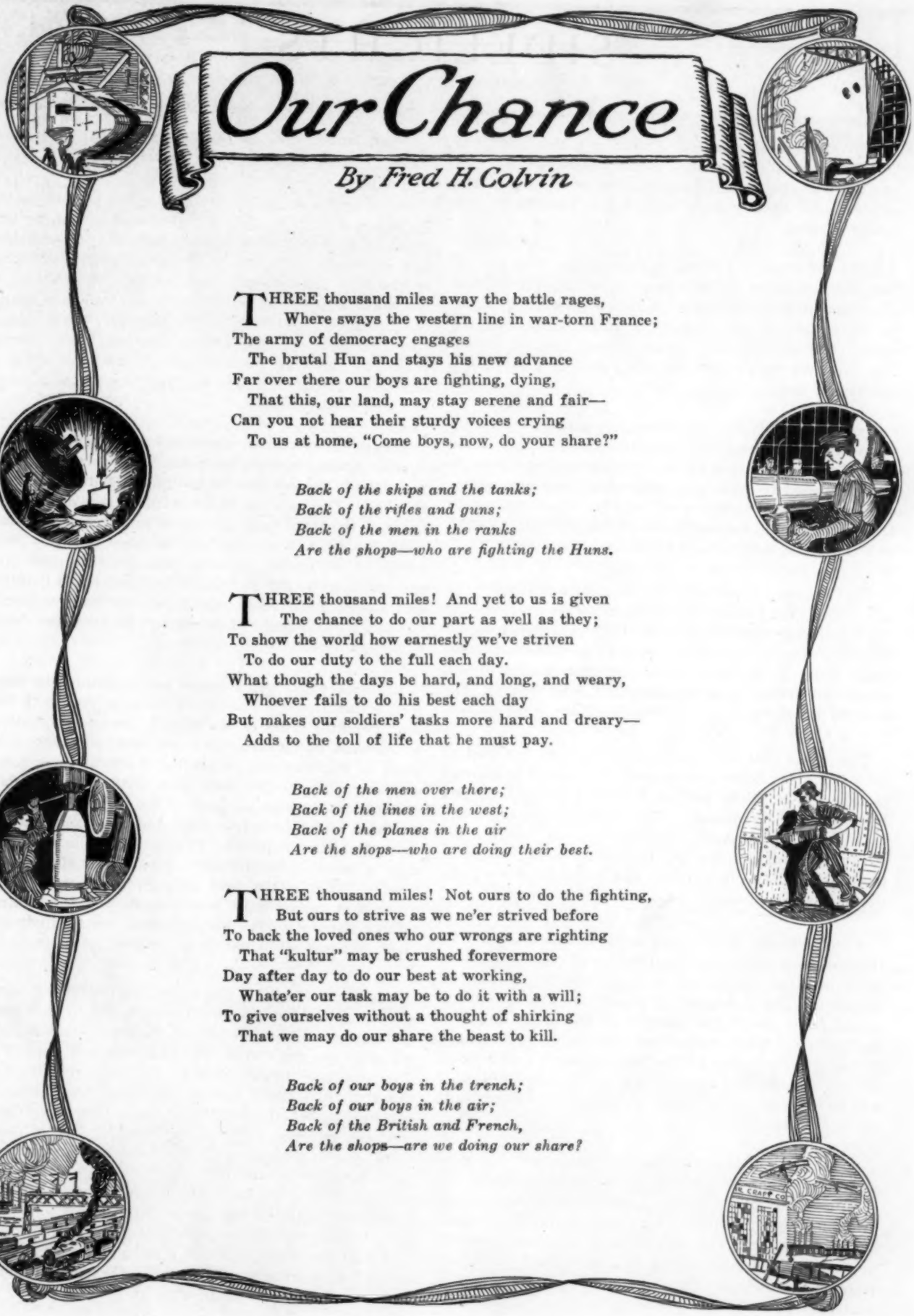
Ever watch one of these "skilled" men turn a shaft to a driving fit? Note how long it took to hammer the inside calipers to a proper feel in the hole, how it took a little longer to hammer the outside calipers (also of the rivet-joint variety) to the right kind of a fit to the insides, and then how long it took to decide that the calipers had just the necessary clearance over the shaft. If the work was done to a drawing an element of uncertainty was present and each man on the job "allowed enough to be sure" with a result that the parts could not be assembled until they were returned to the machines for a shade more off. Setting the calipers to a steel rule to get the right size was a job that required skill. Every man in the room knew that if he used Jim's 9-in. scale, the only one at hand, he would have to set his calipers a little bit more than half a sixty-fourth large or he would make a botch of his work. (Jim's scale was worn off on the ends.)

Contrast the above with a modern (unskilled?) machinist at the same work. He has either a micrometer or a gage and he must turn his shaft within a half thousandth. The other member of the driving fit is bored in another department, also to a gage size, the proper allowance having been determined with mathematical accuracy. A direct reading is obtainable by each man with almost no reliance upon "feel;" the parts made today will fit those of tomorrow. The machinist has done more work; he has done better work, which is another way of saying that he has more skill.

Other Examples

The lathe job is but one example. In every branch of the trade the same is true. The better machines and the better private tools of the workman open a wider field for the machinist, enabling him to do more and better work in less time and with less fatigue. Because of the ever-increasing variety of single-purpose machines few men can in a lifetime gain actual personal experience on all of them and in the various branches of hand work too; but that is not at all necessary to skill. As well say that the men of 1913 were not skillful because not one in 10,000 had ever seen a shell-boring lathe. No one would have called the repair-shop machinist of 1890 unskilled because he had not run everything from a threshing machine to a stationary engine. It is the grasp of fundamentals that counts—the separating of each new proposition into the elements to which those fundamentals may be applied.

Every machine hand on piece work, every one of the women in the shops today has skill, and is applying it. If given different jobs they will apply the skill already acquired and, it is hoped, will analyze the new jobs just as did the old-time machinist when something new came up, though that same machinist would not have called it analysis. Let us get over the notion once and for all that the modern machine-shop worker is lacking in skill. Let us honor those men of other days who worked without the better tools that we have, and let us boost what we have today, knowing full well that if we do not adopt such a policy we will regret it 20 years hence when these same workers are raised to that pedestal engraved "Skill."



Our Chance

By Fred H. Colvin

THREE thousand miles away the battle rages,
Where sways the western line in war-torn France;
The army of democracy engages
The brutal Hun and stays his new advance
Far over there our boys are fighting, dying,
That this, our land, may stay serene and fair—
Can you not hear their sturdy voices crying
To us at home, "Come boys, now, do your share?"

Back of the ships and the tanks;
Back of the rifles and guns;
Back of the men in the ranks
Are the shops—who are fighting the Huns.

THREE thousand miles! And yet to us is given
The chance to do our part as well as they;
To show the world how earnestly we've striven
To do our duty to the full each day.
What though the days be hard, and long, and weary,
Whoever fails to do his best each day
But makes our soldiers' tasks more hard and dreary—
Adds to the toll of life that he must pay.

Back of the men over there;
Back of the lines in the west;
Back of the planes in the air
Are the shops—who are doing their best.

THREE thousand miles! Not ours to do the fighting,
But ours to strive as we ne'er strived before
To back the loved ones who our wrongs are righting
That "kultur" may be crushed forevermore
Day after day to do our best at working,
Whate'er our task may be to do it with a will;
To give ourselves without a thought of shirking
That we may do our share the beast to kill.

Back of our boys in the trench;
Back of our boys in the air;
Back of the British and French,
Are the shops—are we doing our share?

SIDELIGHTS

EDITED BY E. C. PORTER

Provost Marshal General Crowder states that the "work or fight" order has caused 1,000,000 men of draft age to change their employment or enter military service, and that women have taken 500,000 of the places vacated.

* * *

Official Statistical Summary of Japan for 1918 reports that the population of the empire is 54,142,441; number of industrial establishments, 16,809; employees, 910,799, of whom 559,823 are women; average daily hours of work, 14.3; average daily wages of men 28c., of women 13c., of boys under fourteen 11c., and of girls under fourteen 8 cents.

* * *

President Wilson's proclamation urging employers engaged in war work to recruit common labor after Aug. 1 through United States Employment Service only is interpreted to mean that after that date any manufacturer engaged in war work who fails to comply with this request will become liable to be deprived of coal, raw materials and further Government contracts.

* * *

The Treasury department announces that 714,139,119 new coins, with a value of $43,596,895, were made during the fiscal year ending June 30, 1918, which breaks all previous records. The mints worked on a 24-hour-a-day basis most of the year. Over 500,000,000 cent pieces, nearly 83,000,000 nickels, 24,000,000 half dollars, 45,000,000 quarters, and 116,000,000 dimes were coined.

* * *

The report that only banking institutions qualified as United States Government depositaries would be allowed to take subscriptions for the Fourth Liberty Loan has been emphatically denied. "The Treasury Department," says Secretary McAdoo, "desires that all banking institutions shall continue in the future as they have in the past patriotically to assist and coöperate during the various sale campaigns of Government securities."

* * *

About 800,000 ft. of black walnut timber desired by the Government for the manufacture of certain airplane parts is being discovered daily by the Boy Scouts of America. The statement is based on information received from the Forest Service of the Department of Agriculture. Black walnut has been found in 33 states. Word has been sent to the 442,000 Scouts and Scout officials that their canvass should be "so complete that it will be unnecessary to repeat it, even if the war should last five years."

* * *

It is reported that Germany is lining her big guns with a uranium steel which stands up at a rate of fire destructive to all other known steel alloys. A necessary preliminary to the use of such a substance is a supply of ferrouranium. This is ordinarily obtained from the uranium oxide which comes as a byproduct in the extraction of radium from it ores. Accordingly it presents a problem for the electric furnace. This matter is being looked into by the Bureau of Mines in connection with Cornell and other Universities.

* * *

The War Trade Board has authorized persons in the United States to send foodstuffs, funds, clothing and other articles of personal use to Germans or Austrians interned or held as prisoners of war in the United States by the War Department, provided that the consent of the War Department is first obtained and the regulations of the War Department are observed. This authorization applies only to persons held within the United States by the War Department. It does not apply to any prisoners of war held by the United States forces in foreign countries.

* * *

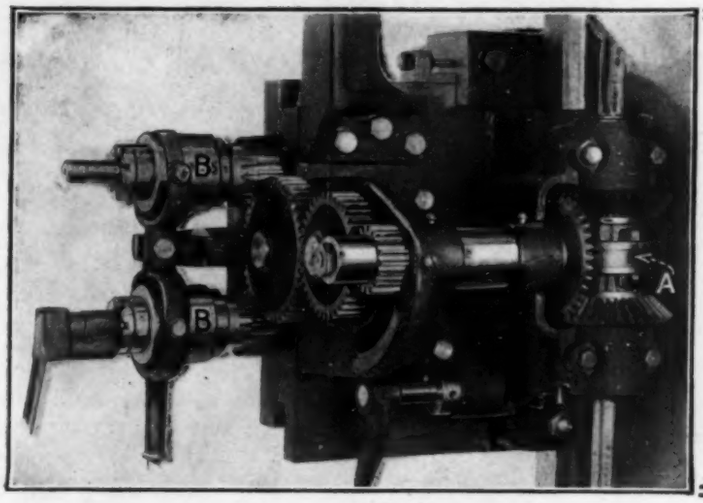
Fourth Liberty Loan bonds now are being turned out by the thousands daily from the Government's engraving plant in preparation for the fourth loan campaign in October. They are identical in form and design with those of the third loan, but space has been left on each bond for later engraving of the exact terms. Three shifts of workmen, including many women and girls, are employed by the Bureau of Engraving and Printing, and James T. Wilmeth, the director, has promised to furnish a full supply of bonds by the time the fourth campaign opens.

* * *

Razors are now being issued to the men of the American Expeditionary Forces. This is in line with General Pershing's desire to have a clean-faced force as an element in morale. Only enlisted members of the army in overseas service are being issued these razors, one being supplied to each man, with replacements in case of loss through no fault of the owner. The razors are of a standard safety type and new blades will be furnished when required. In addition to the razor, each man is issued a toothbrush, comb, hairbrush, soap and towels. This is the first time in the history of the army that razors have been issued, and the Quartermaster General's office has arranged for a supply sufficient to cover all demands.

* * *

There are now 3,378,998 women registered for service according to their specialized talents under the Woman's Committee of the Council of National Defense. The majority are registered for industries and agriculture. This census is being taken by the state committees of the council. These figures represent the incomplete registration returns from 25 states. The census taking has been retarded by the tremendous amount of clerical work, and in some districts by the misunderstanding of persons who believed that the act of registering was equivalent to compulsory labor. A second registration drive will begin in the early fall. The Pennsylvania division has carried the registration through to the extent that the organization is able to report 1481 "placements" of women in work. An informative campaign will precede the second drive.



Manufacturing the Johnson Friction Clutch

Special Correspondence

THE shops of the Carlyle Johnson Machine Co. present an excellent example of the modern self-contained machinery-building plant which, isolated to a certain extent from a base of supplies, must become to a considerable degree independent of it. Located in a small town about ten miles distant from the capital city of Connecticut, but connected therewith by three lines of electric railway, the plant possesses practically all the advantages of urban location without restriction of space, lack of natural light, etc., usually associated with the city shop, and what is of even greater importance, it enjoys more freedom from labor disturbances and a lower rate of labor turnover than is usually the fortune of the latter.

The friction clutch has come to be an indispensable incorporated feature in the driving mechanism of a very large class of independently driven machinery and machine tools, as it has always been a factor with which to be reckoned in what may be termed the old style of overhead drive. Some methods and processes are given.

As might be expected, the main factory is light, clean, and well ventilated. There is a plenty of space for handling the work, and the machinery is so placed that the operations go forward in regular sequence with a minimum of rehandling. On the lower floor adjacent to the castings storage is a battery of Cleveland automatics supplemented by Jones & Lamson flat turrets, upon which most of the round parts of the product is machined by means of special tools which are the product of the company's designing and tool departments.

The company manufactures the well-known Carlyle Johnson friction clutch, some of the methods being here illustrated. In Fig. 1 is shown the parts of the regular form of clutch, *A* being the clutch body, *B* the split ring, *C* the friction cup, *D* the adjusting blocks and *E* the levers. Affixed to the shipper sleeve *F* is the wedge *G*, which by entering between the free ends of the levers causes the split ring to expand against the inner surface of the friction cup. These parts with cotter pins *H*, wedge stop *I*, taper pin *J* (which holds the wedge stop in place in the clutch body) and the small tension-adjusting screw, which can be seen in place in one of the levers in the partially assembled ring, comprise the entire clutch mechanism.

Besides the regular form of clutch, the company builds special forms and modifications to suit builders of all kinds of machinery. In these special forms the body, or the hub of the friction cup, or both, may be modified to suit the requirements of the machine into which it is to be built, as, for instance, the cup may be a part of a gear or pulley, or may be screwed upon the end of a shaft, the hub of a gear, or may be bolted to the face of a cam or other special part.

The clutch is built both double and single end. The

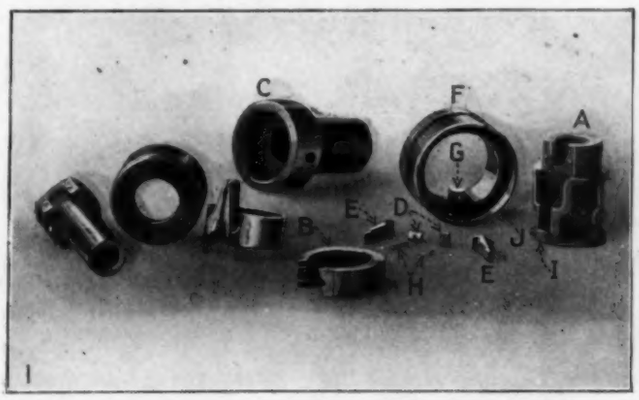


FIG. 1. PARTS OF REGULAR AND SPECIAL CLUTCHES

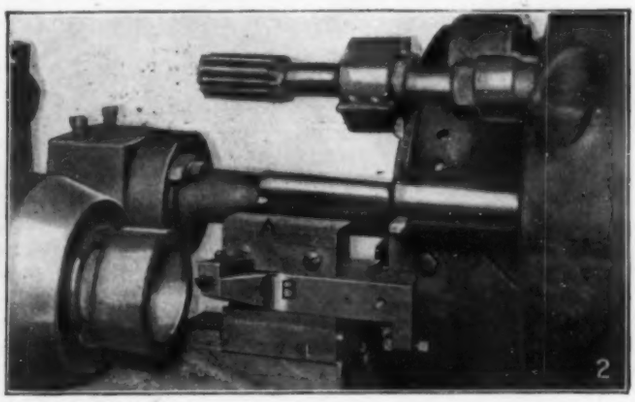
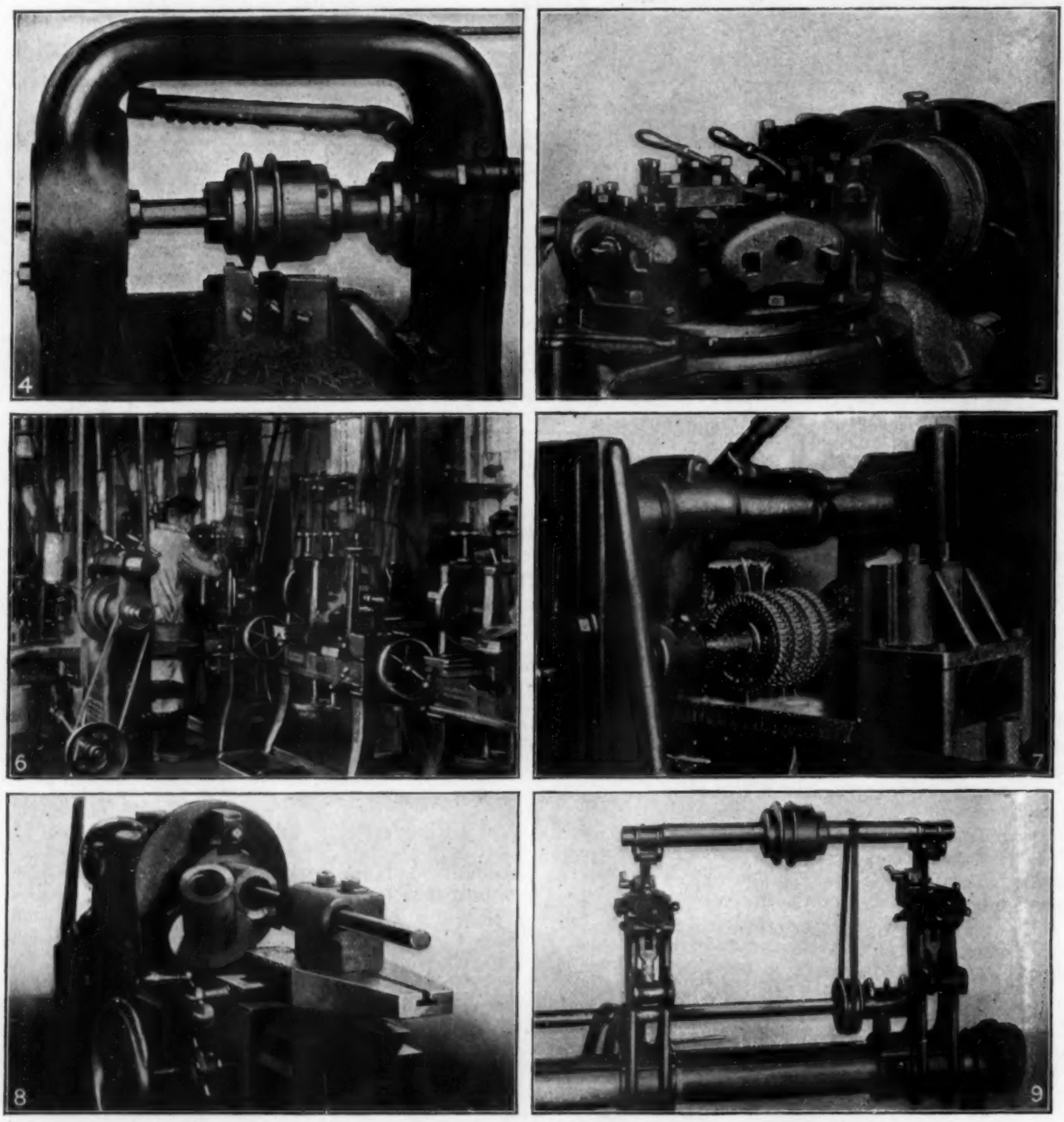


FIG. 2. FINISHING INSIDE OF FRICTION CUP

illustration at the head of this article shows both forms specially built into a well-known drilling machine. At *A* is a double-end clutch in which both cups are integral with the miter gears, while at *B* are two single-end clutches, the hubs of which form pinions for the feed drive. At the left of Fig. 1 is shown a special clutch partially assembled. It will be noticed in this form that the friction ring and levers are standard, while both clutch body and cup are specially formed to meet the requirements of the machine into which they are to be built.



FIGS. 4 TO 9. OPERATIONS ON THE CLUTCH

Fig. 4—Turning the sleeve. Fig. 5—Machining a special sleeve. Fig. 6—Milling small parts. Fig. 7—A reciprocating fixture for milling the levers. Fig. 8—Cutting the oil grooves. Fig. 9—The balancing machine

As the cast-iron parts come in from the castings storage they go to the Cleveland automatics and Jones & Lamson machines for their first operations. The boring, facing and turning of the bodies involve no special operations. The cups are placed in a special form of hinged chuck in the automatic where they are faced, bored and reamed, and the inside of the cup finished. For this operation, which is shown in Fig. 2, a small bracket *A* is mounted upon the cross-slide of the automatic, which bracket carries the tool slide *B*. At the proper point in the cycle of operations this tool, being automatically set for diameter by the cross-slide cam, is fed forward by a flat piece of hardened steel attached to the forward face of the turret bearing against the adjusting screw at the rear end of the slide. When

the tool reaches the bottom, the turret comes to rest and the cross-slide again comes into action, feeding the tool over the bottom of the cup, thus finishing the entire inside surface with what is practically one movement.

For the next operation on this part it is transferred to another machine of the same type, where it is held by a special chuck which is none other than the John-

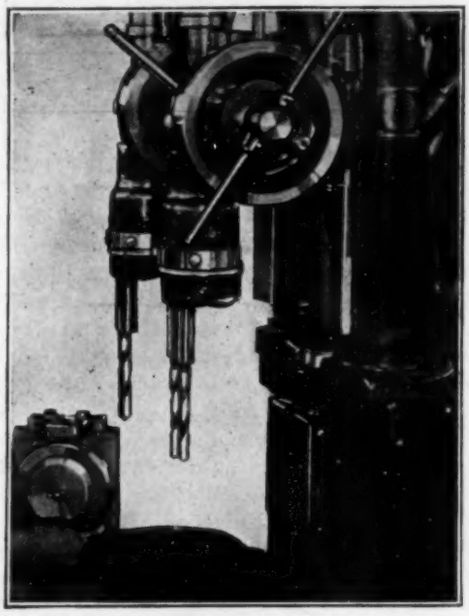


FIG. 8. DRILLING POCKETS FOR LEVER SEAT IN RING

son clutch with a special body made to screw upon the spindle nose of the machine. There is a chuck of this kind for every size of clutch, and in addition to furnishing a very convenient means of driving the work, they form an effective link in the inspection system, for if this chuck refuses to take a cup because of the latter being too small, or will not drive because of its being too large, the cup is obviously of no use as a clutch part. With the cup in place on this chuck the outside is finished complete in one operation by regular forms of tools and movements.

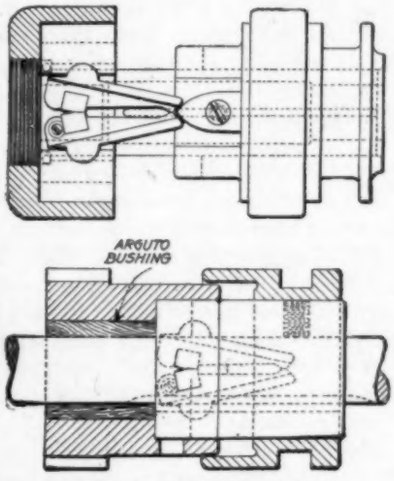


FIG. 10. SPECIAL FORMS OF CLUTCH

The friction rings are first finished upon the automatic as a long bushing of proper bore and diameter, after which they are cut apart by a gang of parting tools and their outside surfaces finished to size by grinding. These rings are usually of cast iron, but are sometimes made of bronze for special purposes. Two small holes are now drilled lengthwise through each ring for the cotter pins which retain the levers.

From this operation they pass to the drilling machine shown in Fig. 3, where in a special jig two parallel holes are drilled and reamed. They now go to the milling department, where the metal between the holes is removed by two saws cutting approximately through the centers of the holes, taking out a section of the ring and leaving two semicircular pockets which form the seats of the expanding levers.

For finishing the shipper sleeve a somewhat novel method is employed. While the milling machine is not infrequently used for turning operations on special work, this firm is using it in this manner as a regular feature. The operation is shown in Fig. 4, where a sleeve may be seen mounted upon the arbor, while the cutter is bolted to a block fastened to the machine table. The cutter stands at an angle of about 15 deg. from the center line of the arbor, thereby making a shearing cut, and although the piece is finished at one pass, the cut is not as harsh as it looks.

In Fig. 5 is shown the machining of a special sleeve for one of the larger sizes, the operation being performed upon a Jones & Lamson machine.

There are several interesting milling operations on the levers, which are drop-forgings of mild steel, and

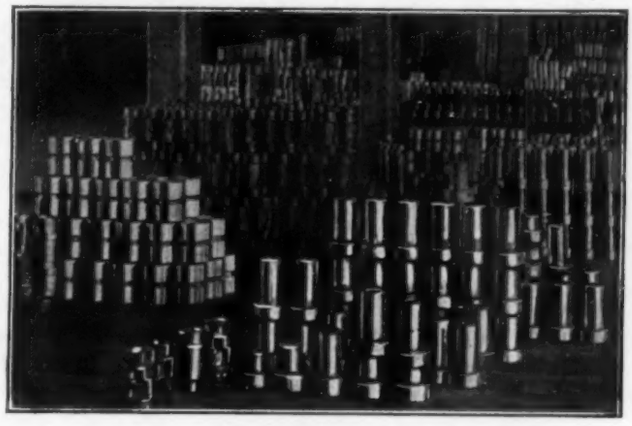


FIG. 11. A CORNER OF THE STOCKROOM

on the adjusting blocks, which are made of tool steel. These operations are accomplished mostly on milling machines of the Lincoln type, a group of which is shown in Fig. 6. Most of the fixtures used are in the form of small vises with jaws made to conform to the shape of the piece to be milled.

For milling the sides of the levers the reciprocating fixture shown in Fig. 7 is used, one pair of levers being finished for each reversal of the table. While the cutter is at work on one pair, the operator is removing the finished pair from the opposite end of the fixture and setting in another pair to be milled.

The hub of the friction cup of this clutch is ordinarily used for the purpose of mounting a gear or pulley on a shaft in such manner that it may be stopped independently of the latter. In this case the bearing is grooved for the distribution of oil, the groove being put in by the machine shown in Fig. 8. These bearings may be of cast iron integral with the cup, they may be bushed with bronze or with any specified anti-friction bearing surface.

After assembling, each clutch is tested for running balance, and any error in this respect corrected. The balancing machine is shown in Fig. 9.

The line drawings, Fig. 10, show two forms of special clutch, both of which have been mentioned in this article. It will be observed that the friction ring and expanding device are standard in each case.

Fig. 11 shows a corner of the finished-stock room, which adjoins the assembling department.

The factory uses the group system of electric drive, which with the free use of their own product upon the overhead work results in a remarkable absence of noise and dirt, which is the inevitable adjunct of the old style of main-line drive with a countershaft for every machine, and it also lessens to a considerable degree what may be aptly referred to as "overhead expense."

The Draftsman and the Shop

By Albert F. Guyler

Much has been said anent the feeling between the draftsman and the man in the shop, and the trend of these comments leads one to the conclusion that the former is a downtrodden individual who gets the blame for every error in the works whether the fault is his or not.

On consideration it is only natural that he should be accused of more errors than the other men in the work because as a rule he handles more jobs than they and his instructions for working are less cut and dried. Most jobs which enter the works pass through the drafting office, yet its staff may be less than 1 per cent. of the total number of employees.

When the shopman receives a drawing from which to work, he expects and usually gets definite instructions as to what is required, the drawing as a rule giving all necessary information.

Information given the draftsman relating to the job is not infrequently most meager, the one giving the information apparently not wanting to give away any secrets, but he will go to great lengths to explain the most obvious things and leave out essential details. Strength of parts, choice of materials and arrangement of details are often left to the draftsman.

Mistakes Only Are Advertised

One remarkable difference in the work of the draftsman and that of the shopman is that in the one case it is only the mistakes that are advertised while in the other the good work receives all the attention. If the drawings are correct no mention is made of the fact, while if an error is made the whole factory hears of it. Should any work be spoiled in the shop, two or three at most know of it and the matter is soon forgotten, but work correctly made is called "output," and everyone knows of it.

In many cases the chief is to blame for the shopman's impression of the draftsman. He it is who receives instructions, hands out the work, decides what form the design shall take (often this is a choice of ideas submitted by the draftsman) and looks over and passes upon the complete design, yet if the question of accuracy is later brought up, the matter is referred straight back to the subordinate.

In the machine shop or toolroom the foreman and inspector act as a kind of buffer, and responsibility for errors is to a certain extent divided, but whenever there is any question of design the draftsman is brought into it straight away because apparently he is the only one who knows why the design was so made. If the chief were in a position to give a direct answer to queries raised by the shop the draftsman would not receive nearly so much criticism.

Perhaps it is expecting too much in one man to want the chief to have the ability of a detective in finding out exactly what is wanted, the mind of a schoolmaster to know exactly how much the draftsman requires to be told of it, enough confidence in himself to tell a man with a pet idea that he is on the wrong track, and sufficient knowledge of mechanics to be able to explain why; but there are various kinds of chiefs.

Of one of these kinds was Tim. His office was a small one, having only three draftsmen, one boy and Tim, who also acted as checker, his method being, if the drawing was simple, to alter a few figures here and there (the drawings were all in pencil and photostat prints were taken from them), and he would do this without consulting the draftsman, but fortunately his figures were so distinctive that they could easily be picked out and if his pencil had not gone right through the paper they could be altered back again. When the drawing looked rather complicated he would give a lecture on always being sure to make no mistakes, as "at some firms the draftsman is held responsible for any errors in his drawings and no check is made." Then he would say, "Just look it over again," and that was Tim's check.

An Actual Case

At the mere suggestion of error from the shop he would cry in despair to the draftsman: "I say, Mister, you've let me down again," and one man had so many false alarms of this nature that he made a list of each, giving drawing number, date, complaint, actual error and whose. Out of the first 20, two were from Tim's "checking," which had not been altered back, 16 were up to the shop and two were up to the draftsman.

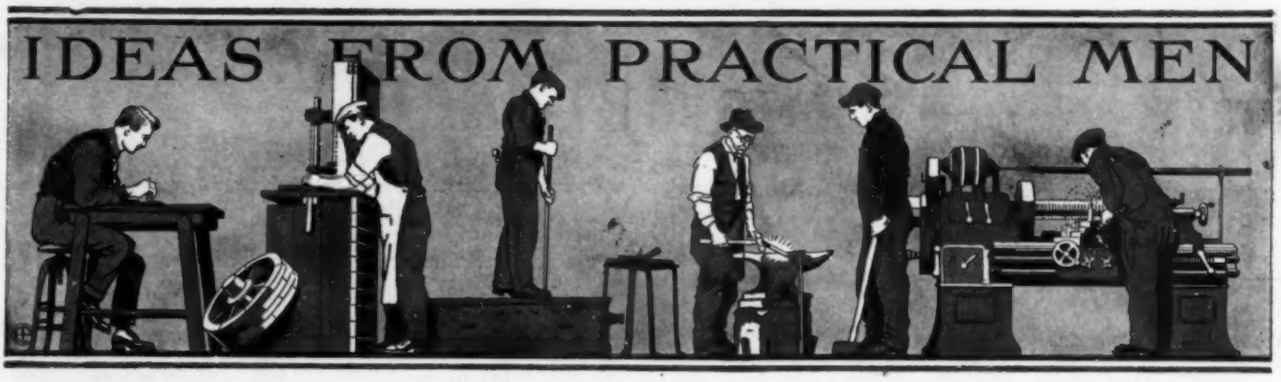
The toolroom foreman at this place was a German—whom Tim called Herr Müller when he was not there and Mr. Miller when he was—a really smart engineer, but one who would have things exactly as he wanted them without any suggestions, and in this Tim always backed him up.

Herr Müller had an idea for a special machine for a line of goods manufactured by the firm, and brought in sketches from which to have complete drawings made. The draftsman looked over the sketches and suggested moving a train of gears. "Oh, no," said Müller, "if you will it do like der drawing dat vill us satisfy."

When made the machine proved highly successful and a number of others were required for other sizes of the article. Once more the draftsman endeavored to have these gears moved to a more favorable position, and again the opposition of Mr. Müller and Tim stood in the way of efficient design.

An indicator gage reading to 0.0001 in. was designed by Müller. The layout showed that an error of 0.002 in. would pass undetected and Tim almost apologized to Müller because his man found it out.

Tim never liked the idea of his men working with their coats off, and when a visit to the shop was necessary he would say, "Put your coat on, you look like a common workman." Do you wonder that they were always having new draftsmen in that office?

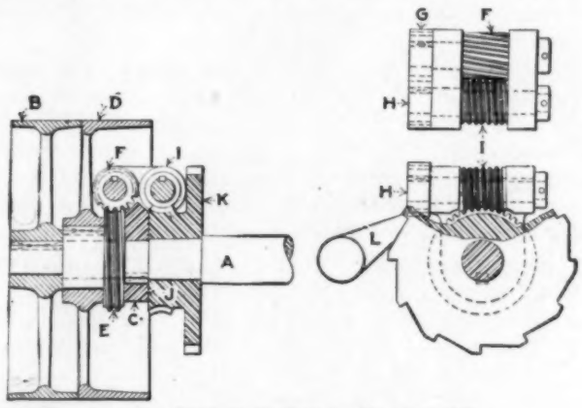


Speed-Reduction Device with Novel and Valuable Features

BY P. ZULINKE

While the speed-reduction device which operates the indexing mechanism of automatic screw machines performs its work satisfactorily in the main there are minor points wherein it is susceptible of improvement. With the device now in general use it is impracticable to change the ratio of reduction, and further when running at high speeds it is apt to be noisy.

The device here described and illustrated overcomes to some extent the first of these objections in that it allows a variation in ratio by the simple expedient of



NOVEL SPEED-REDUCTION DEVICE

changing a couple of gears not unlike the change gears of a lathe.

Referring to the illustration *A* is the shaft upon which is keyed the tight pulley *B* and the spider *C* which carries the reducing gears. *D* is a loose pulley upon the hub of which is the worm *E* meshing with wormwheel *F* keyed to a short shaft carried by the spider *C*. Upon the shaft with wormwheel *F*, and also keyed to it, is a gear *G* meshing with gear *H* upon a similar shaft which carries the worm *I*. This worm meshes with wormwheel *J* which is made integral with the ratchet *K*.

When the belt is on tight pulley *B* the whole mechanism revolves as a unit, but when the belt is shifted to loose pulley *D* the movement is as follows: The top of the pulley moving away from the observer moves the small wormwheel in a contra-clockwise direction. This worm, through the medium of gears *G* and *H*, drives worm *I* in the opposite direction, which would tend to drive the wormwheel *J* and ratchet K in a direction opposite to that of the driving pulley.

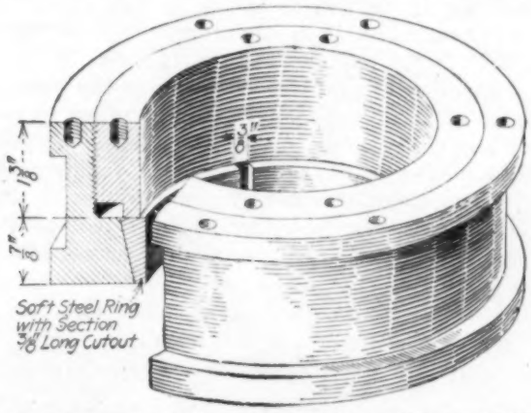
As movement in this direction is opposed by the pawl *L* it follows that the spider *C*, which it will be remembered is keyed to the shaft, will be forced to revolve in the same direction as the driving pulley and at a speed determined by the ratio of reduction in the gearing.

Let us suppose worm *E* to be single thread and worm wheel *F* to have 10 teeth, the same data to apply to worm and wormwheel *I* and *J* respectively. With gears of equal diameters at *G* and *H* the speed ratio would be as 1 to 100. This can be modified by using any desired ratio at *G* and *H*, it being necessary only to provide gears whose combined pitch radii equals the center distance of the two shafts.

Self-Centering Work Carrier for Use in a Steadyrest

BY MARTIN H. BALL

The illustration shows a self-centering work carrier, or chuck, designed for the purpose of supporting unfinished bars of round section in the steadyrest when the number of pieces required is too large to warrant centering each piece and turning a place for the steadyrest jaws and yet requires too accurate internal work to allow them to be run upon the rough surface of the bar.



RING CHUCK FOR RUNNING WORK IN THE STEADYREST

The illustration is almost self-explanatory. The outer ring is of cast iron turned on the outside to receive the jaws of the steadyrest, and on the inside a portion is threaded for the pressure ring, while the remainder is bored taper to fit the outside of the split clamping ring.

A clamping ring is required for each size of stock to be used. To tighten the carrier on the stock the outer ring is held by a spanner while the threaded pressure ring is turned in by a second spanner.

EDITORIALS

Carry On!

THE poem entitled "Carry On," which we published some time ago, has attracted so much attention, and we have had so many calls for it, that we are now issuing it in the form of an insert which accompanies this issue. This is a very strong appeal from the man in the field to the man in the shop, and we sincerely trust that it will bring home to many the realization of the necessity of sticking to the job until the war is won. Nothing must delay production.

The Status of Partially Disabled Soldiers

AS IS generally known there is distinct movement on foot looking to the retraining of crippled soldiers so that they may become self-supporting and a factor in modern industry. This rehabilitation is absolutely necessary both for the self-respect of the individual and the welfare of the community, and every industry must prepare to so readjust its organization that the requisite proportion of partially crippled men may be satisfactorily employed.

One of the most difficult problems in this connection is the exact status of such men in industry after their return to employment. It involves the rulings of the various state compensation boards and the casualty companies, and these are being consulted with a view to outlining some definite and equitable plan to make the status of these men clear.

In this connection it is of interest to note that in Great Britain the casualty companies have, by formal action, unanimously refused to advance the rates on employers of retrained soldier labor in order to avoid putting any obstacle in the way of finding employment by those men who have been refitted for industrial life. This attitude, while highly commendable, is nevertheless the only one that can be tolerated, as it is unthinkable that any additional handicap could be placed in the way of those who have become even partially incapacitated while fighting our fight for us.

Getting Co-operation in the Shop

IT DOES not require either prophecy or investigation to see that production of all essentials is the one great factor in winning the war. But it does require a very clear vision to see and understand the various factors which enter into production.

We have been accustomed to consider only the physical conditions of the shop, and not all of these. We have given great care and study to cutting tools, to work speeds and feeds, to all the mechanical elements, but we have not always appreciated the effect of these on either the physical or mental well-being of the individual.

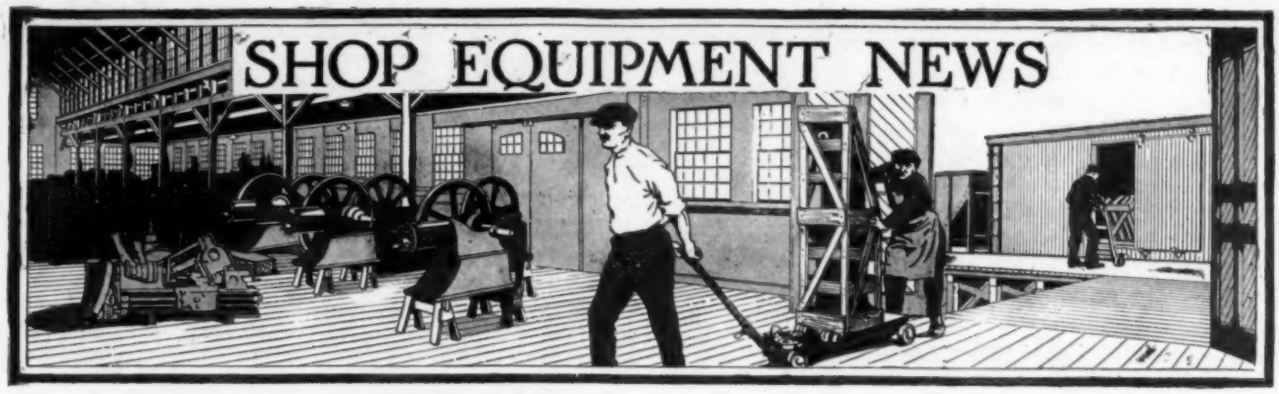
We have been accustomed in the past to a condition where there was more apt to be an oversupply of labor than a shortage, and the law of supply and demand has regulated labor more completely than any other factor of production. The present scarcity of labor has changed this condition. Wages have increased tremendously, and for the first time in the lives of this generation at least many workers are in a position to lay off occasionally without running into debt. In other words, they can now buy leisure in the same way as the bank president buys leisure at Palm Beach or at the Thousand Islands. And being able to take a rest occasionally he sees no reason for not laying off to see a ball game when he knows the boss spends long week-ends at the shore.

With the necessity of constant work removed, other motives must be provided, the nature of these varying with the personality of the men to whom they appeal. One method which has worked well in some shops is a bonus for steady workers. This varies from 5 to 10 per cent. for each full week or from 10 to 15 per cent. for each full month. In some cases this bonus is more effective in War-Savings stamps or in Liberty bonds than in cash, and this is to be preferred when possible as it helps to instill the fact that we are all partners in the greatest corporation on earth—the United States of America.

But back of all this, back of any method which can prove successful, must be a realization of the responsibility of each individual to do his share. There can be no better patriotism than this, but it cannot be secured by spellbinders with flags and ranting. It must be far deeper than that. It must be free from every trace of spread-eagle flamboyancy and political bluff—for the average worker can tell the genuine article more quickly than the highly educated college professor.

An excellent way to secure this personal responsibility is by well-planned shop meetings and judicious speakers who must be of the right kind or the results will be disappointing and may be distinctly harmful. Well-dressed and able-bodied individuals who the men know earn good salaries by a few hours of work devoted to telling others how to serve their country do not command wholehearted respect in the average shop. Even if they are over the draft age they are apt to be classed as slackers, and nothing kills respect so quickly as this.

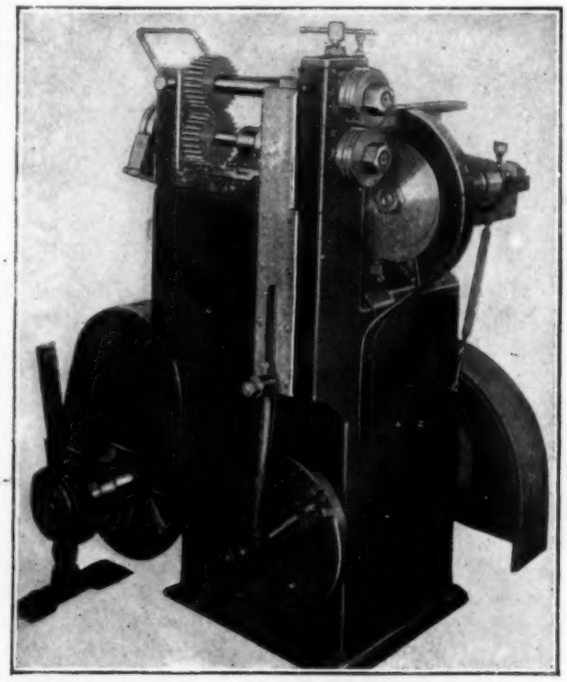
The best men to arouse enthusiasm; to secure coöperation, are those who have been across in the thick of it, or are about to go. There is no bluffing there. A man in khaki with an empty sleeve need not be an orator to fire every man in the shop with a desire to let nothing stand in the way of our boys over there getting everything they need. A man who has been in the fighting, even if he escapes without a scratch, is listened to and is heeded. Five-minute talks by such men can make more of an impression on the ordinary man as to the need for production than our most gifted orators can in an hour. The man who has faced death himself commands more attention than he who only points out the path to danger. Our shopmen are loyal and they will respond when the true appeal is made.



This department is open to all new equipment of interest to shop owners. Photographs and data should be addressed to Editorial Department, "American Machinist"

Hallden Automatic Tube and Rod Cutting Machine

The Hallden Machine Co., 27 Benedict St., P. O. Box 1074, Waterbury, Conn., has recently placed on the market a machine shown in the illustration, which is for automatically cutting off tubing and rods. The

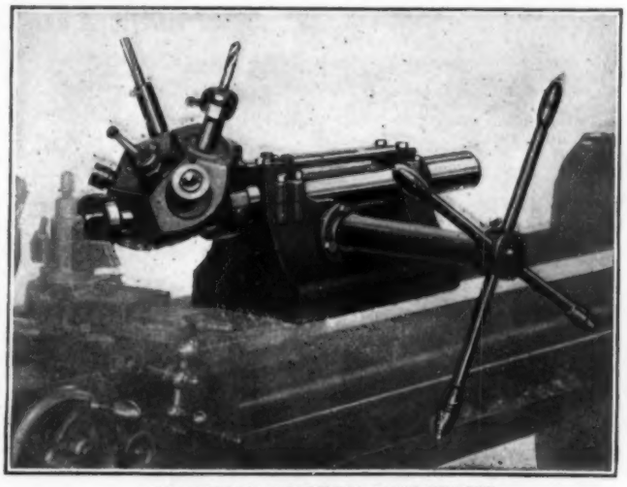


AUTOMATIC TUBE AND ROD CUTTING MACHINE

tube or rod being operated upon is fed to the saw by means of a pair of feed rolls which revolve intermittently, and at each pause the saw table is raised and a piece of metal cut off. The feed mechanism consists of a reciprocating rack with one end connected to an eccentric and the other end meshing with a gear connected to a one-way clutch. On the downward stroke the feed rolls are stationary and the saw table is raised upward by a cam connected directly to the driving shaft of the feeding mechanism. While the saw is operating the piece is held by the feed rolls and the stock casing and the end being cut off is held by a special clamping device which releases as soon as the saw has completed its work. The eccentric can be adjusted to give any desired length of stroke to the rack so that the machine will cut the desired lengths. When cutting brass or copper a regular metal saw is used, but where steel is being cut a metal disk moving at high velocity gives better results. The capacity of the machine depends of course upon the size and class of material being cut, small brass tubing being cut off at the rate of 120 to 300 pieces per minute, copper tubing being cut at the rate of from 60 to 150 pieces per minute and steel tubing at the rate of 60 pieces per minute. The machine can also be made to cut at an angle if this feature is desired. The machine is entirely self-contained and SKF ball bearings are used for the fast-running shaft and the motor. A Johnson friction clutch is used for stopping and starting the feeding mechanism. The electric motor furnished is of 1 or 2 hp., depending upon the work, and the weight of the complete machine is approximately 700 pounds.

Jones Superior Turret Tailstock

The turret tailstock shown in the illustration is one of the recent products of the Jones Superior Machine Co., 1258-72 West North Ave., Chicago, Ill. The de-



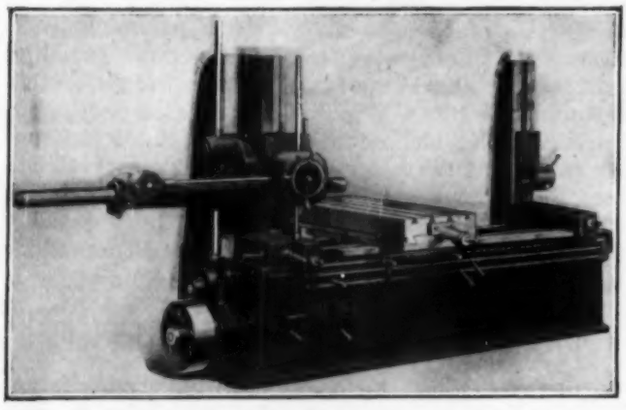
SUPERIOR TURRET TAILSTOCK

vice is intended for use where lathe work is being handled that requires a number of operations which can be performed at one chucking. The turret is rotated by hand, but is automatically indexed in order to give each tool proper alignment with the headstock

spindle when it is in working position. It will be noticed that the bar that carries the turret head operates on the center line of the lathe, it being claimed that this construction prevents undue vibration and stresses. The turret head is of cast iron and is bored with five holes. These are left slightly smaller than required, it being intended that these shall be bored out to size after the device is in place on the particular machine on which it is to be used. The slide is of machine steel, 4 in. in diameter, the rack being fastened to the under surface. The gear meshing with this rack is rotated by the handle at the front. The tailstocks are furnished machined on the lower surface as may be required by the purchaser, and with the proper distance from the lower surface to the center of the spindle in order to bring the spindle in line with the headstock spindle of the machine on which it is to be used.

Lambert Horizontal Boring Machine

The Lambert Machine and Engineering Co., Cleveland, Ohio, is now marketing the horizontal machine shown in the illustration, which is for boring, milling, drilling and tapping purposes. The machine is intended



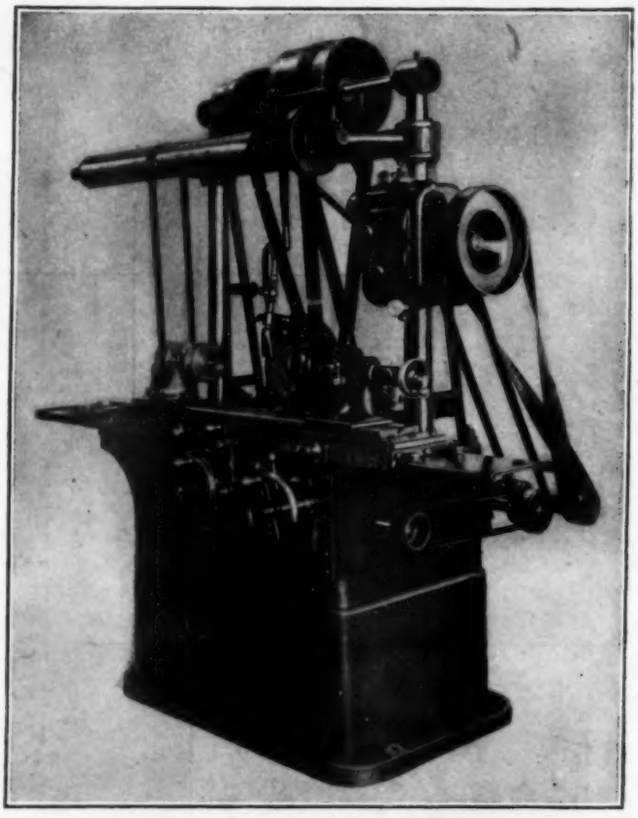
LAMBERT HORIZONTAL BORING MACHINE

Diameter of bar, 3 in.; taper of bar, Morse No. 5; longitudinal travel of bar, 24 in.; vertical travel of head with vernier reading, 22 in.; vertical travel of head with dial reading, 30 in.; maximum distance from spindle to top of table, 30 in.; minimum distance from spindle to top of table, 4 in.; size of table, 20 x 48 in.; crossfeed of table with automatic stop, 38 in.; longitudinal travel of table on bed with power, 52 in.; maximum distance from faceplate to outer support, 72 in.; size of driving pulley, 14 x 4 in.; speed of driving pulley, 250 r.p.m.; number of spindle speeds, twelve, 15 to 225 r.p.m.; number of feeds available in either direction, sixteen, 0.005 to 0.333 in. per spindle revolution; approximate weight, 8000 lb.

to be driven directly from the line shaft, a clutch being incorporated for stopping and starting. The speeds are 12 in number and range from 15 to 225 r.p.m., while 16 feeds are provided ranging from 0.005 to 0.333 in. per revolution of the bar. Bronze bushings are used on all the bearings and all gears are of steel. Verniers are provided for making head and outer support adjustments. All gearing is inclosed and controlled by means of the levers shown at the front of the machine. A special feature is the stop and start levers, which are placed to be particularly convenient. These can be seen at the front mounted on two rods which run the length of the machine. The handles can be slid along these rods to any position within easy reach of the operator. It is said that the operator can control the entire machine without taking his eyes from the work.

Fraser Universal Grinding Machine

The Warren F. Fraser Co., Westboro, Mass., has placed on the market a new line of universal grinding machines, one of which is shown in the illustration. The machines are made in four sizes, namely, 10 x 30, 12 x 30, 10 x 42 and 12 x 42 in. The machines are equipped with 12 changes of table speed ranging from 12 to 235 in. per min. and 12 work rotation speeds ranging from 14 to 279 r.p.m., these being all obtained through the medium of a quick-change gear box which is incorporated in the machine. Three wheel speeds are provided and the countershaft runs on roller bear-



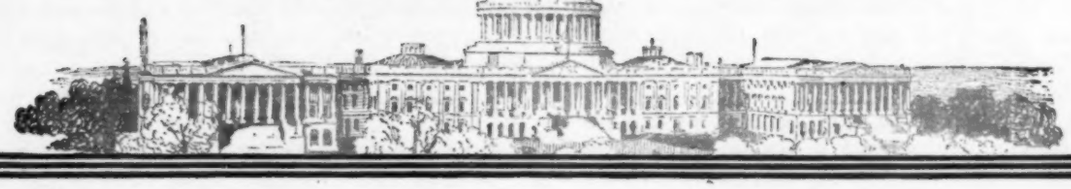
FRASER UNIVERSAL GRINDING MACHINE

ings at the rate of 900 r.p.m. The machine can be driven direct from a line shaft or motor, as desired, and is equipped with the Fraser automatic reversing movement. This movement gives a slow traverse to the table at the end of the stroke and brings the table to rest before the clutch is shifted to drive in the reverse direction. This feature is claimed to make a grinding machine which is exceptionally smooth in operation and a machine on which it is possible to employ the highest rate of table traverse without undue shock or jar resulting.

Sheffield Thread-Lead Testing Machine For Screw Gages—Erratum

The address of the Sheffield Machine and Tool Co. was given incorrectly on page 180. This company is located at Dayton, Ohio. It should also have been stated that the accuracy of the testing machine is dependent upon the Johansson gage blocks with which it is intended to be used.

LATEST ADVICES FROM OUR WASHINGTON EDITOR



Washington, D. C., Aug. 3, 1918.—As I see it one of the brightest spots in the aircraft situation at present is the sort of men which Mr. Ryan is getting around him. Personnel plays a tremendous part in any enterprise, and it is indeed gratifying to find such men as Archer A. Landon and C. W. Nash connected with the production of aircraft, which is so sadly needed. We have slipped several cogs in the whole proceeding, but there is every reason that we may anticipate real results in place of promises as soon as the new organization can be put into working order.

Later Developments

The latest developments in the aircraft situation seem to bear out some of the suggestions pointed out in these letters some weeks ago. According to the statement of the Bureau of Aircraft Production the De Haviland biplane is the only one which we are producing in quantities, owing to the failure of the Bristol fighter in almost every particular. This is the plane which I mentioned several weeks ago as having been so "improved" by the engineers of the Signal Corps that the first machine built from the drawing supplied could not be assembled. Further improvements evidently were not sufficient to make it a desirable machine, and it became known among aviators as a man-killer, earning this title in too many cases. It was evidently a wise move to discontinue its production, and if the SE-5 and Caproni planes, which it is reported are to be built in its place, can be put into production without too much "improvement" by engineers who are evidently not qualified for this work we may well forget the amount of money wasted on the Bristol experiment.

It is much more difficult, however, to forget the number of months which have elapsed since the Curtiss company was compelled to waste its time on a machine which its own engineers were confident would never be a success. Had it been allowed to continue its order for Spads we might have had at least several hundred of these on the other side before this.

The De Haviland machine too is being seriously criticised, but it is also defended in some quarters. It is certainly hoped that the machines sent across are at least fairly satisfactory, as without them we should be very largely dependent on our allies for flying equipment.

There can be no question as to the capacity now available for building both planes and motors, but there is serious question in many quarters as to the mental capacity being displayed by some of the engineers having these matters in charge. Judging from the results, or perhaps from the lack of results, it seems as though the time had come when a number of the engineers now engaged in the airplane program should be given a vacation and then asked to take up some other line of work.

Some of them deserve great credit for the work they have already done, but when a man gets to the point where most of his activity is devoted to proving that every new suggestion is of no value, it is high time that he was relieved of all work having to do with developments of either motors or planes. At present this seems to be the attitude of some of the engineers who have done excellent work during the past year, and I repeat that when any man gets to the point of believing that no one else can improve his designs and devotes all of his time to proving that new suggestions are of no value it is time he was slated for another job.

The Production of Munitions

While most of us are beginning to realize that we are at war there are a few not closely in touch with the production of munitions of various kinds who do not realize the extent to which this work is being carried on. In many ways it is little less than marvelous to note the progress we have made during the past year. At the present time our daily average output of cartridges for rifles, machine guns, pistols and revolvers is about 15,000,000, although nearly double this number has been inspected and accepted in a single day. Rifle production is averaging something over 54,000 a week, with pistols at 8700 and revolvers at 6100. Machine-gun production for the same time was a little over 2000 light Brownings and almost 1100 heavy Brownings. The total production of rifles of all types is given at 1,826,759, which does not include 600,000 Springfields on hand at the beginning of the war. Neither does it include thousands of complete rifles represented by spare parts.

All previous records for inspection and acceptance of rifles were broken last week when at one plant in a single day 7000 rifles were turned over to the Government.

These numbers are beginning to be very encouraging, and it is also interesting to note that great secrecy seems to have given way to an intelligent dissemination of the general facts in which we are all interested.

As has been previously noted the supplying of war industries with common labor was centralized in the United States Employment Service of the Department of Labor on Aug. 1, affecting for the present only manufacturers having a payroll of more than 100 men.

This will be extended to skilled labor as soon as possible, and in the meantime recruiting of skilled labor for war production will be subject to federal regulations which are now being prepared.

There is being formed in each community a local community labor board consisting of a representative of the United States Employment Service, a representative of employers and of the employed. This board will have jurisdiction over recruiting and distributing labor in its locality.

In order that each community may be fully protected a survey of labor requirements is now being made, and rulings have been issued that no labor be transported out of any community by the United States Employment Service without the approval of the state director. No labor may be removed by the United States Employment Service from one state to another without the approval of the Washington Office. Every effort will also be made to discourage any movements from community to community or from state to state by any other service.

It is also interesting to note that farm labor is to be protected, as the industrial program distinctly includes special efforts to keep the farmer supplied with labor. In some states this is being done with considerable success.

Assigning State Quotas

When the survey of labor requirements has been completed and the aggregate demand for unskilled labor in war work is determined, each state will be assigned a certain quota representing the common labor to be drawn from among men engaged in nonessential industries in that state. These state quotas will in turn be distributed among localities. Within each locality employers in nonwar work, including those who are only partially on war work, will be asked to distribute the local quotas from time to time among themselves. The object of this is to keep any community from being drained of labor and to use a local supply as far as possible for all local demand. Circumstances are sure to arise in certain cases, however, where some may have to be transported a considerable distance.

Nearly every day brings us some new activity concerning the running of machine shops, which would have been unheard of in prewar times. The question of securing adequate houses for labor is a tremendous problem and is being met in a number of different ways. The Bureau of Industrial Housing and Transportation, for example, proposes to build from 1200 to 1500 houses at Bethlehem, Penn., on a tract of 300 acres in the outskirts of the city, in order to provide homes for workers in the Bethlehem Steel Co. The transportation problem ties up very closely with this, and as a result the houses are to be built of brick because this can be obtained in the immediate neighborhood and delivered by trucks. The houses will contain from five to six or more rooms and be on plots of ground about 40 x 100 feet.

Another effort to relieve congestion is brought about by coöperation with the Railroad Administration. Under this plan a special train for munition workers is being run from South Amboy to Asbury Park so that those who are unable to find suitable accommodations near the plant can live along the shore during the summer and in this way help both ends of the line. This service will probably be extended to Elizabeth, N. J., and the round-trip fare of 30c. has been put into effect.

Although this may seem like an inconsistency in the face of the recent advance of railway fares it must be remembered that the Railroad Department of the Government can easily afford to lose considerable money if the cost is less than the cost of accommodating the workers in other ways.

New Rules Governing Priority in Production

The rules and regulations here given governing priority in production will supersede all directions, rules and regulations heretofore promulgated by the Priorities Committee. All priority certificates heretofore issued and now outstanding shall remain in full force and effect according to their original terms.

During the war all individuals, firms, associations and corporations engaged in the production of raw materials and manufactured products (save foods, feeds and fuels) are requested to observe the following regulations respecting priority, namely:

Classifications

All orders and work are divided into five general classes: Class AA, Class A, Class B, Class C and Class D, with subdivisions of Class AA, Class A and Class B indicated by suffix number, thus: Class AA-1, Class AA-2, etc.; Class A-1, Class A-2, etc., and Class B-1, Class B-2, etc.

Class AA comprises only emergency war work of an exceptional and urgent nature.

Class A comprises all other war work; that is to say, orders and work necessary to carry on the war, such as arms, ammunitions, destroyers, submarines, battleships, transports, merchant ships and other water craft, airplanes, locomotives, etc., and the materials or commodities required in the production or manufacture of same.

Class B comprises orders and work which while not primarily designed for the prosecution of the war yet are of public interest and essential to the national welfare or otherwise of exceptional importance.

Class C comprises all orders and work not covered by priority certificates issued by the Priorities Committee or not taking an automatic rating in accordance with the provisions of Sections 7, 8 and 9 hereof, which orders and work are to be utilized in furtherance of one or more of the purposes embraced within the "General Classification of Purposes Demanding Preference Treatment" promulgated by the Priorities Board, appearing on page 17 of this circular, as same may be from time to time amended or substituted; or which orders and work are placed by or are to be utilized in connection with an industry or plant appearing on Preference List No. 1, promulgated and published by the Priorities Board under date of Apr. 6, 1918 (as set forth on pages 18 and 19 of this circular), and all amendments or substitutes therefor. No Class C certificates shall be issued.

Class D comprises all orders and work not embraced in Class AA, Class A, Class B, or Class C, and no certificates will be issued therefor. All orders for work or materials not covered by priority certificates or not taking an automatic classification in accordance with the provisions of Sections 8 and 9 hereof and not taking a Class C classification under the provisions of Section 5 hereof will fall within Class D.

Automatic Classifications

Each order placed after June 30, 1918, by a duly authorized officer of the War Department or of the Navy Department of the United States, or of the United States Shipping Board Emergency Fleet Corporation, which falls within Class A as defined in Section 3 hereof, shall by virtue of

this rule, upon the placing of the order, automatically be classified as A-5, provided said order carries an indorsement personally signed by the officer placing the order reading:

Unless rerated by express order in writing by the Priorities Committee of the War Industries Board this order is by authority of said Priorities Committee rated as Class A-5, and its execution shall take precedence over all your orders and work of a lower classification to the extent necessary to insure delivery according to the date specified herein, as prescribed by Circular No. 4 issued by the Priorities Division of the War Industries Board of date July 1, 1918, and all amendments thereto.

Each order for materials, equipment or supplies for the purposes or uses hereinafter in this section mentioned shall by virtue of this rule automatically take a classification as herein prescribed, namely:

a. For the manufacture of turbines (all classes)..... A-4
b. For the repair or construction of steam-railroad locomotives for use on the railroads under the jurisdiction of the United States Railroad Administration..... A-4
c. For the production of electrodes..... A-5
d. For the manufacture of rope wire and of wire rope..... A-5
e. For the building of ships or other water craft for and under direct contracts with the United States Shipping Board Emergency Fleet Corporation..... A-5
f. For the building of all cargo water craft (but not pleasure craft) save such as are under construction by or for the United States Shipping Board Emergency Fleet Corporation A-6
g. For the manufacture of machine tools for working both metal and wood; of machinists' tools, of small tools, of hand tools and of mining tools, machinery and equipment A-6
h. For the manufacture of steam-railroad materials, equipment and supplies (other than locomotives) for use on the railroads under the jurisdiction of the United States Railroad Administration..... B-1
i. For the manufacture of locomotive cranes and traveling cranes B-1
j. For the manufacture of electrical equipment other than turbines (but not electrical supplies as distinguished from equipment) B-2
k. For the manufacture of farm implements..... B-2
l. For the manufacture of textile machinery..... B-2
m. For the manufacture of tools, implements, machinery and equipment required for the production, harvesting, distribution, milling, canning and refining of foods and feeds B-2
n. For the manufacture of binder twine and rope..... B-2
o. For the manufacture of oil-well supplies or equipment—by which is meant supplies for the production of petroleum and natural gas—but not including pipe lines, storage tanks of 1000 barrels capacity or over, tank cars or refineries..... B-2

No order shall take an automatic classification under the provisions of Section 8 save where the person intending to use the materials, equipment or supplies ordered states under oath in writing that they are to be used for one or more of the purposes mentioned in this section and for no other purpose, which affidavit shall be indorsed on or attached to the order and shall be in the form following:

Unless rerated by express order in writing by the Priorities Committee of the War Industries Board this order is by authority of said Priorities Committee rated as Class —— under and by virtue of Subdivision —— of Section 8 of Circular No. 4 issued by the Priorities Division of the War Industries Board of date July 1, 1918, and all amendments thereto.

For the purpose of securing the said rating I do solemnly swear:

1. That I have taken and filed whatever pledge is required by the War Industries Board from the Industry of which I am a member; and

2. That the materials, equipment or supplies covered by this order are intended for use, and will be used, for the purpose or purposes mentioned in the said subdivision or subdivisions of said Section 8 and for no other purpose.

Each order for materials, equipment or supplies for such purposes or uses as fall within Class C as defined in Section 5 hereof will automatically be classed as Class C, provided the person intending to use the materials, equipment or supplies ordered shall file with and as a part of said order an affidavit in writing in the form following:

Unless rerated by express order in writing by the Priorities Committee of the War Industries Board this order is by authority of said Priorities Committee rated as Class C under and by virtue of Section 9 of Circular No. 4 issued by the Priorities Division of the War Industries Board of date July 1, 1918, and all amendments thereto.

For the purpose of securing the said rating I do solemnly swear:

1. That I have taken and filed whatever pledge is required by the War Industries Board from the Industry of which I am a member; and

2. That the materials, equipment or supplies covered by this order are intended for use, and will be used, for the purpose or purposes mentioned and referred to in Section 5 of said circular and for no other purpose.

Where the party placing an order under Sections 7, 8 or 9 hereof conceives it to be in the public interest that the order should take a higher classification than the automatic classification prescribed herein, then in such event an application for such higher classification setting forth the reasons therefor may be filed and same will be considered by and promptly acted upon by the Priorities Committee. No such application should be made, however, save in cases where the automatic rating will not secure delivery on or near the date required, and such application must disclose facts evidencing that the public interest requires an earlier delivery of the order than can be secured under the existing automatic rating. The application must be made on the regular Priorities Committee Application Form P C 15.

All orders save such as are automatically classed under the provisions of Sections 7, 8 and 9 hereof shall be automatically classed as Class D unless covered by certificates or other written directions issued in accordance with the rules and regulations embodied in this circular or amendments thereto.

Rules of Precedence

Orders and work in Class AA shall take precedence over orders and work in all other classes; those in Class A shall take precedence over those in Classes B, C and D; those in Class B shall take precedence over those in Classes C and D; those in Class C shall take precedence over those in Class D; all irrespective of the dates the orders were placed.

Orders and work in Class AA-1 shall take precedence over orders and work in Class AA-2 and all lower classes; those in Class A-1 shall take precedence over those in Class A-2 and all lower classes; those in Class B-1 shall take precedence over those in Class B-2; etc.

Orders in Different Classes

The classification of an order simply means that it shall be given such precedence over orders of a lower classification as may be necessary (and only such as may be necessary) to insure delivery on the date specified in the order. It does not mean that work should cease on orders of a lower classification or that the order should be completed and delivery made in advance of orders taking a lower classification if this is not necessary to effect delivery within the time specified. The one to whom a priority certificate is directed or with whom an order taking an automatic classification is placed should make his own production plans so as to get the maximum of efficiency out of his operations, making all deliveries at the times contracted for, if possible, and where this is not possible giving precedence to the orders taking the highest classification.

Orders in Same Class

As between orders in the same subdivision of a class (as A-1), except where otherwise specifically requested by the committee, the date of delivery contracted for will control unless this will operate to delay the delivery required by an earlier order of the same class, in which event the earlier order will have precedence in delivery. For example: Two orders, Order X and Order Y, are both covered by A-1 certificates. Order X is dated Oct. 1, 1918, and calls for delivery Feb. 1, 1919. Order Y is dated Nov. 1, 1918, but calls for delivery Jan. 1, 1919. As between these two orders preference will ordinarily be given to Order Y because it calls for an earlier delivery date. If, however, such delivery will delay the completion of Order X, then preference should be given Order X, because it is the earlier order. If possible, both orders will be completed on the delivery dates called for. The dates of the certificates are not controlling.

In case of doubt as to which certificate or order should have precedence, the matter should be laid before the committee by correspondence or in conference, so that the committee may give specific instructions.

Applications

Applications for priority certificates must be made on the form of application prescribed by this committee. As a general rule where an application is necessary it should be made by the one intending to use the materials, equipment and supplies.

United States Government

If the order has been placed by some purchasing officer of the United States Army, Navy, Shipping Board, Emergency Fleet Corporation or any other branch or department

of the Government the application should be made by and in the name of the department or official for whose account the order has been placed.

Allied Governments

If the order has been placed for export to the territory of an allied government or for delivery to an allied government or to some person for account thereof the application must be made to this committee through and with the written approval of the War Mission which is representing said government in the United States and also with the written approval of the Allied Purchasing Commission.

A Government Contractor

One who has a contract with the Government or with the Allies and who needs priority assistance to obtain the materials, commodities or work to fill such contract may make application direct to this committee. In some instances the committee will have already issued a priority certificate against such contractor directing him to give priority to the filling of his Government contract or contracts. In other instances such certificates will not have been issued. In either event, however, one who is working on Government contracts may make application direct if he needs priority assistance. While it is not necessary for such applications to be made through or with the approval of the Government official placing the contract it is desirable that this course should be pursued where it will not involve substantial delay. Where this course is not pursued such applicant's connection with the Government work and the correctness of his representations will be verified and checked by the committee.

Government Subcontractors

Those who may be one or more times removed from a direct contractor with the Government or with the Allies, but who are furnishing materials, supplies or commodities to be used in connection with the fulfillment of such direct contract, may make application direct to the committee for such assistance as they may need to obtain such materials, commodities or supplies. Such applications need not be approved by either the principal contractor or by the agency of the Government or the Allies placing the original order, but the representations of the applicant will be verified by the committee.

Applicants Not on Government Contracts

One who has placed an order for any material, commodities or supplies which fall within Class B, and who requires priority assistance to procure reasonably prompt delivery thereof, may make application direct to the committee. In such cases the paragraphs in the application seeking to elicit information with respect to the applicant's connection with the Government or Allied contracts may be disregarded.

Applications for priority should be made against the actual producer or manufacturer. The committee will not—save in exceptional cases where the issuance of a certificate will clearly expedite the filling of an important order—administer priority against jobbers, brokers or middlemen.

Premature Deliveries

In placing orders care should be exercised in determining the date that delivery will actually be required. The contractor should not ask to have delivery made before he will be prepared to use the articles. A rigid adherence to this rule will greatly facilitate timely deliveries of urgent orders and prevent needless interference. The application must state the date of delivery promised by the producer.

War Department Centralizes Purchasing Control

Organization of the centralized purchasing scheme whereby the General Staff controls the buying of all commodities and supervises all contracts for the army is rapidly progressing. Already assignment of purchases of a number of commodities has been made to the several branches of the War Department, and boards of review are passing on all contracts in order to insure uniformity of contract control and provisions. The general administration of the scheme is under the direction of Brig.-Gen. Hugh S. Johnson, head of the purchase and supply branch of the division of purchase, storage and traffic of the General Staff of the army.

In the past the various branches of the department have been buying their respective commodities through their own purchasing agencies, often bidding against one another for the same goods and frequently paying different prices for the same article. The General Staff brought together a committee of representatives of the various purchasing agencies, and this committee is now engaged in standardizing the commodities needed and assigning to one branch of the department the purchase of each commodity. This standardization has progressed to the point indicated in the schedule, which shows the name of the branch intrusted with the purchase of about 150 items so far agreed upon. Others are being added to the list each day.

Thus machine tools, regardless of their use or of the branch that uses them, are purchased by the Ordnance Division according to specifications laid down by that division. Any other branch requiring machine tools makes a requisition on the Ordnance Division for the required amount. More than 70 per cent. of the articles bought by the department are now being purchased under this system.

Extension of Purchasing

A further extension of purchasing is the establishment of boards of review which have to pass on all contracts before they become valid. Boards of review have been established in each of the eight purchasing bureaus; that is, quartermaster, construction, ordnance, engineers, signal, aircraft production, medical and chemical and war gas. Each board consists of men representing purchasing, finance, production and contracts. This board passes first on all contracts of more than $5000, second on all cost-plus contracts and third on all formal competitive bidding contracts where the contract is not awarded to the lowest bidder by the local officer. It sits every day and goes over each contract—those from remote points by telegraph if necessary—and approves only those that are in accordance with the rules laid down by the main committee on purchases or which seem to be at prices in accordance with the state of the market.

In addition to these departmental boards there is a superior board of review, consisting of General Johnson, a representative of each minor board and Max Thelen, who is surveyor of contract. This superior board passes on large questions of purchase and contract, lays down the general rules of purchase and acts as a court of appeals from the lower boards. In general any dissatisfied prospective contractor has the right of appeal to the superior board.

In standardizing the work of purchasing, this superior board is making a number of reforms. For instance, it is preparing a card index of all purchases made by the War Department, according to a punch-card system, whereby the prices and contract requirements can be told for all previous purchases at a glance. Thus, the board can keep tab on the contracts submitted as to

price, quality, delivery, etc. The superior board too is deep in the study of contract forms so as to standardize the various specifications and contracts and to protect the Government as to price, terms and conditions. The cost-plus form of contract is particularly under scrutiny just now and will probably be standardized in the near future.

More than 3000 separate purchase transactions are now passing through the War Department each day, to say nothing of the construction contracts that also come under the jurisdiction of the boards of review. The perfecting of the present system is expected not only to insure more efficient purchasing by the Government, reducing as it does the multiplicity of purchasing and inspecting effort, but also will be of material advantage to the manufacturers, who for any one product or group of products will have to deal with only one agency in the War Department.

AIRCRAFT
Electric cable
Clocks, etc.
Compasses
Airplane gas engines
Oil, air and gasoline gages
Steel hangars
Thermometers
Brass tubing
Copper tubing
Electric wire

CHEMICAL WARFARE
Gas containers

CONSTRUCTION
Builders' hardware
Electrical equipment and supplies
Fire engines
Refrigerating equipment
Fire apparatus
Room heaters
Heating equipment and supplies
Nails
Plumbing equipment and supplies
Water-supply pumps
Refrigerating machinery
Reinforcing bars
Reinforcing rods
Sprinkler system
Structural steel
Water-supply tanks
Ventilating equipment
Water-supply equipment

ENGINEERS
Boilers, stationary, and appurtenances
Chain
Containers, paint, etc.
Gantry cranes
Locomotive cranes
Gas engines
Steam engines
Gas-electric generator sets
Steel fence posts
General pumps
Tank-car pumps
Railway - contractor plant
Railway equipment
Mechanical rubber goods
Barbed-wire staples
Barbed wire
Wire poultry netting

MEDICAL
Surgical needles
Medical thermometers

ORDNANCE
Chrome alloys
Ferroalloys
Manganese alloys
Aluminum
Antimony
Barometers
Dry batteries
Blast-furnace and steel-mill products
Steel caissons
Artillery chain
Copper
Forging equipment
Fiber hull
Dry-cell flashlights
Portable cap lanterns
Portable hand lanterns
Lead
Steel limbers
Machine tools
Mercury
Nonferrous metals
Steel-mill products
Nickel
Optical instruments
Platinum
Time-interval recorders
Arc searchlights
Silver
Tin
Pig tin
Plate tin
Tungsten
Stop watches
Steel-wire carts
Zinc

QUARTERMASTER
Automobile drive chain
Non-skid chain
Motor-drawn fire engines
Woven-wire fencing
Fire extinguishers
Garment - workers power tools and machinery
Needles
Gasoline pumps
Oil pumps
Gasoline tanks
Oil tanks
Tool chests
Truck tanks
Wire products

SIGNAL
Radio equipment
Wire rope
Telephone equipment
Telegraph equipment

Reclaiming Inspection Gages at Washington

The gage section of the Inspection Division of the Army Ordnance Department has started a shop at the Bureau of Standards for the reclamation of master inspection gages that have been rendered obsolete due to revisions in drawings by the Engineering Bureau. The manufacture of master inspection gages when these are urgently required will also be undertaken for the Ordnance Department.

At present the shop is running about twenty skilled toolmakers, but when machine tools and other equipment that have been under order shall have been received the working force will reach sixty or more. The reclamation of obsolete gages will result in a considerable money saving and in addition will permit of the almost immediate use of gages which, were they to be replaced on order, would require three to four months to deliver.

The work for the Inspection Division is in charge of Glenn B. Harris, who was formerly on the editorial staff of the *American Machinist*, as its gage engineer. H. L. Van Keuren, chief of the gage section of the Bureau of Standards, is in active charge of the work at the shop. The machine tools and equipment which have been purchased are up to date and are in addition to a large number already at the bureau.

The shop is located in one of the new fireproof buildings recently completed for war purposes and will be provided with everything necessary for the comfort of the men and the proper carrying on of the work. A competent force is now being brought together.

An idea of the equipment of the shop, as well as the work it can perform, may be gathered by the list of machines which follows:

EQUIPMENT OF GAGE SHOP

Milling Machines—Two B. & S. No. 1 universal; 1 Van Norman No. 2; 1 Waltham thread, cutters and attachments; 1 bench-milling machine, Sloan & Chase.

Grinding Machines—Three B. & S. No. 2 surface; 3 B. & S. abrasive surface; 2 B. & S. No. 1 universal; 2 Rivett No. 103 internal; 2 Rivett No. 106 internal; 1 Norton plain; 1 Heald cylinder; 1 Van Norman ball race; 1 Johnson-Cataract thread; 1 Gardner disk; 1 universal gage; 2 tool-grinding machines.

Lathes—One Rivett grinding; 3 Pratt & Whitney; 1 Hendey (metric); 2 Sloan & Chase bench; 3 Sloan & Chase 7-in.; 1 Mulliner-Endlund 12-in.

Drilling Machines—One Champion 20-in.; 2 Langelier sensitive; 3 drilling machines.

Shaping Machines—One Potter & Johnson 15-in.; 1 Steptoe 20-inch.

Screw Machines—One Warner & Swasey.

Lapping and Filing Machines—One Oliver; 1 Robinson No. 2½.

Thread-Grinding Machines—Two Presto thread-grinding attachments; 1 Nestor; 1 Blair.

Magnetic Chucks—One D. & W. Fuse Co.; 2 O. S. Walker Co.; 1 Simmons P. & W.; 1 D. & W. rotary; Radnetic parallels.

Shop Furniture—24 bench legs; 12 shop stools; 6 countershaft standards; 1 scraping table; 48 steel lockers; steel tool cabinets; Prentiss vises.

Power Transmission—Two electric motors.

Training for Overseas Service at New York University

As part of its war work New York University is training 1800 National Army men, 600 at a time, as gas-engine men, automobile repairers, chauffeurs, blacksmiths, carpenters, machinists, concrete workers, radio operators and in other crafts. These men, on the completion of their courses, are assigned to various army units, so that each division will be mechanically complete when it goes overseas. More than 100,000 are being trained this summer in 100 schools of engineering and technology throughout the country.

The military training at the university is under the direction of Capt. W. S. Maulsby, who is assisted by 10 line lieutenants and two medical officers. The technical training is given by 30 instructors.

The executive officer of the army in charge of all the training schools is Capt. Chesleigh H. Briscoe, formerly a New York lawyer. Dean Charles H. Snow of the university's School of Applied Science has general supervision there, his title being Civilian Director of the New York University National Army Training Detachment.

When the War Department embarked on its extensive plan for training soldiers in mechanical trades it decided instead of acquiring land, erecting barracks and assembling teaching staffs to have the instructions given in colleges already equipped with facilities. The first contract of that kind was signed with New York University.

The men being trained at the university come from New York and upstate towns and are assembled at the University Heights buildings. They use the Hall of

Fame and the gymnasium as barracks, and their mess is held at a special building where they are served on the cafeteria plan.

While the Government has supplied a number of army trucks and automobile parts for instruction the men are so eager for work that the instructors have been compelled to call for help, and automobile repair shops are sending dilapidated cars by the hundreds to University Heights. The car owner pays for the repair parts, but the university makes no charge for the work done. The men are taught "battlefield repairing;" that is, to work with as few tools as possible and under conditions nearly approaching those in actual warfare.

The concrete class, said to be the only college class in concrete work in the world, was organized by chance, and the instructors say that it is turning out some fine gun-base builders. It happened that the university was erecting an annex to its chemistry building and the men volunteered to put up the foundation if they were taught. The foundation went up in a hurry, and then it was discovered there were a number of places for building concrete walks. When these opportunities were exhausted the men even did work outside the campus and are keeping their instructors busy finding new openings for their efforts.

Killed in Action

Corp. Edward J. Farrell, Jr., the first of our boys in service to give his life in battle, fell on July 13. He thus fulfilled to the utmost the final sentences of his will written last Thanksgiving Day:

"To the little old U. S. A. I give my life willingly because she is the grandest and freest country in the world. And I hope to God that the day will come when she will be indeed 'America for Americans' of undivided allegiance. Selah!"

Farrell, who made up the *American Machinist* for four years, enlisted as a first-class private in the Signal Corps a week after war was declared. He reported for duty about a year ago, was assigned to the Pratt Institute for special training in radio work and progressed with marked rapidity. Last November when a depot battalion of radio men was organized for overseas service he was selected as one of a half dozen needed to fill up the ranks, and on Monday following Thanksgiving he was on a transport sailing for France. Soon after arrival he was assigned to Company C, 101st Field Battalion, Signal Corps, and promoted to corporal. From that time until his death his service lay in helping to keep up the communication by radio and in the signal platoon.

Future Trade Must Include the World

By G. A. O'Reilly
Irving National Bank

If we are to do justice to the opportunities which the world trade of the future holds for us, whatever they might be, we must provide ourselves with a much more nearly complete equipment than that upon which we have depended in the past; we must realize that, whatever our disposition, American trade of the future must be a world trade and must be built upon a plan which will recognize world needs. We must impart to our producing machinery a quality of versatility that will enable us to comply with special demands of particular foreign markets and at the same time take full advantage of our proved genius for production along standardized lines.

We must develop a foreign-credit equipment, not necessarily along English or French or German lines but along sound and flexible lines, so that in world competition we may be able to extend to desirable foreign customers, safely and consistently, whatever credit consideration may be required in securing or holding the particular trade in which we are interested.

Complete Control

We must possess and control a complete trading proposition instead of one in which profitable details are farmed out to others, as was the case before the war. For illustration: Our foreign-trade contracts should be domiciled at home instead of abroad as now, and in the adjudication of questions arising in connection with these contracts American tribunals should be considered at least as seriously as those of any other country.

We must develop American exchange and educate the markets of the world to an appreciation of the commercial advantages which it presents. Dollar exchange looks very good just now during the war when we occupy a preferred and controlling commercial position, but it is a rash financier who will express more than the hope that it will look equally good after the war when the commercial machinery of the nations has been released and free buying and world competition again become facts.

We must develop an American merchant marine which will enable us to put our goods into the markets of the world without reference to the convenience of any but ourselves and under conditions which will give our prices the benefit of any special advantage which may result from the use of complete and exclusively American-controlled transportation facilities.

We Must Learn Foreign Markets

We must learn foreign markets, their methods and peculiarities, and must develop complete selling machinery of our own instead of following the absurd practice of the past, in which the sale and reputation of our goods were intrusted to foreign agents selected frequently from among our most active competitors.

We must increase our national commercial horizon; must broaden our national commercial point of view; must realize that foreign trade, and particularly the foreign trade of the future, is sufficiently serious and valuable and difficult to justify special treatment. This trade must be supplied from a production planned with particular reference to the requirements of foreign trade, and not as at present from a perhaps accidental supply remaining after providing for domestic trade.

Above all we must nationalize our trade, our methods, our processes and, to the greatest consistent extent, our contact with both foreign customers and competitors.

While plans of the trade for the future must be built upon knowledge which only the developments of the future can bring we at least can build in the present so strongly as to provide against whatever dangers may come. In other words America should extend her preparedness program to the world of trade, the future of which is full of immense possibilities.

More Officers for the Engineer Reserve Corps

People generally do not realize the immense amount of construction work which is now required by an army in action, and that this has far outstripped the capacity of the normal arrangements made for such work. There is, however, a serious shortage of engineering and construction men in the United States Army as well as in the armies of England and France. Not being military nations they did not study so closely the various phases of the war program in time to secure full coördination of the various branches. This is, however, being remedied, and there are excellent opportunities for engineers and construction men of various kinds.

It seems hardly believable, but it is stated on good authority, that the operation of an army has now become only one-fifth strictly military, the remaining four-fifths being nothing more nor less than simple construction of every variety. This includes construction and reconstruction of standard-gage and light railways; canals; Belgian-block, macadam, asphalt and plank roads; docks, bridges, grading, concrete work, timber operations, water works, sewers, drainage, dams, wells, telephone and telegraph lines, underground cables,camps, dugouts, gun emplacements, trenches, barbed wire and other projects too numerous to mention. In the past the bulk of such work was relegated to small auxiliary forces of trained workmen and mechanics called engineers in military language. The commissioned officers of these forces are composed of military men and other experienced engineers who have been trained in military engineering.

The immense amount of construction and other engineering work has completely overwhelmed the engineering forces ordinarily available, and the fighting organizations have been compelled to participate more and more in a class of activity which they do not like. Attempts have been made to operate under the direction of a very few experienced men detailed from the engineers, but this has always met with the difficulty that such a man has no authority over the men he is directing and, particularly in the case of incompetent men, such direction is resented. In order to meet this situation it has become necessary to provide an adequate percentage of commissioned and noncommissioned officers who have been properly trained as military men but who are also familiar with construction work and the handling of men on such work. The commissioned officers may be taken from the engineers and the construction superintendents of the country while the noncommissioned officers may be men who have had experience as foremen on construction work.

Grades To Be Commissioned

The Engineer Reserve Corps now requires about 2000 officers in the grades of first lieutenant and captain, and applications for such commissions are being received from qualified engineers. Recruits for this service should have a clear conception of the obligations they assume. They are soldiers and are enlisted or inducted as such, but in order to facilitate the assignment of proper personnel each man is classified according to his vocation in civil life. The chief training in the service is along the lines of combat, military engineering and camp duty. When the exigencies of the situation require, however, men are called upon to perform tasks for which their training in civil life has best fitted them.

Applications from qualified engineers will be given every consideration, and enlistments from men whose qualities are such that they can serve in engineering organizations are desired.

The examining board can only receive applications for appointment in the grades of first lieutenants and captains, the required ages being from 32 to 36 years for first lieutenant, and from 36 to 42 years for captain. These limits may be slightly increased or decreased in special cases except that in no instance can anyone within the draft age be considered.

Applicants must be engaged in the active practice of the engineering profession or in one of its various branches and be in good physical condition. No set rules have been established in regard to professional qualifications and experience. An applicant's fitness for commission will be determined by the examining board in each case. All applicants must be citizens of the United States, but no applications can be considered from anyone born in a country with which the United States is at war, or an ally of such a country, regardless of whether he is naturalized or not.

Application blanks and full details of the requirements may be had by applying to Major-Gen. W. M. Black, Chief of Engineers, Washington, D. C.

Decreasing Labor Turnover in Detroit

The manufacturers of Detroit have banded together to reduce labor turnover and seem to be succeeding to such an extent as to warrant a careful consideration of the methods they employ. As long ago as last April the Employers' Association of Detroit succeeded in inducing a number of manufacturers to agree to the discontinuance of local advertising for help, and the agreement has been renewed month by month ever since. About 600 firms are now included, from which it is easy to see the great possibilities of such an agreement. Nearly all join in a favorable expression of opinion as to the benefits derived, while the comparatively few who do not realize that they have been benefited are for the most part those conducting a small business in which the turnover was relatively little.

The Employers' Association also has under way an elaborate plan for arousing the enthusiasm and interest of the workers in their endeavor to secure the highest possible efficiency and, with it, production. In brief, it consists of the enlistment of employees in a munition or industrial army, which includes a badge as a reward for faithful attendance. This badge is being advertised so that its full meaning will be clear to the general public, which, of course, gives it an added value to the wearer. This publicity campaign will be carried on through the newspapers, on billboards, on the screens at picture houses, on shop posters, and also be the theme of four-minute speakers who address the workers from time to time in the different plants.

The Employers' Association reports considerable success in this matter and it believes that similar plans will also prove successful in other localities.

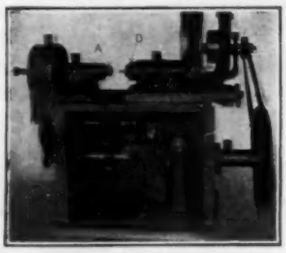
Condensed-Clipping Index of Equipment

Clip, paste on 3 x 5-in. cards and file as desired

Presses, Single-Action "C 14"
Ferracute Machine Co., Bridgeton, N. J.
"American Machinist," July 4, 1918

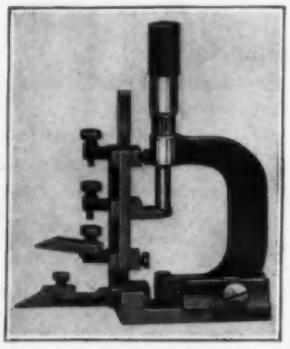
The illustration shows one of a new line of single-action presses. The specifications for the fourth size in the series are as follows: Pressure exerted, 35 tons; weight, 4700 lb.; stroke of ram, 2 in.; adjustment of ram, 3 in.; width of opening through back, 17 in.; height of opening through back, 11 in.; throat from center of ram back to frame, 9 in.; height from bed to ram at top of stroke and adjustment, 10½ in.; diameter of flywheel, 35 in.; width of flywheel, 6 in.; weight of flywheel, 750 lb.; diameter of steel shaft at journals, 3½ in.; diameter of shaft at crank, 4½ in.

Milling Machine for Powder Pockets in Firing-Pin Plugs
Automatic Engraving and Manufacturing Co., 79 E. 130th St., New York City
"American Machinist," July 4, 1918



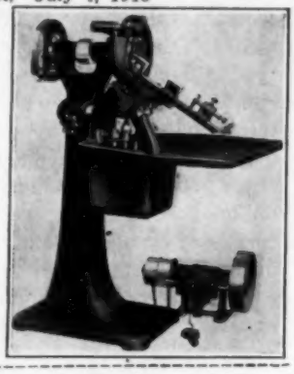
A semi-automatic machine for milling the powder pockets in the firing-pin plug of French type high-explosive shells. These pockets are in the form of two semicircular grooves extending part way around a center hole and are approximately 0.07 in. wide and 0.15 in. deep. The milling cutter D is made from a piece of drill rod by simply filing it flat on two sides and giving the necessary clearance for cutting. This runs 2000 r.p.m. and the time required to mill both slots is 10 sec., the work being held on the expanding chuck A. The illustration shows the machine with the front cover removed.

Calipers, Height-Gage Attachment for Micrometer
Henry O. Costello, 91 Raymond St., Providence, R. I.
"American Machinist," July 4, 1918



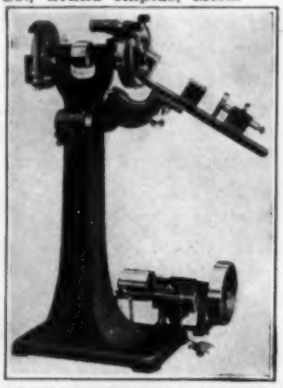
This device allows an ordinary micrometer to be used on work that is ordinarily in the field of the vernier height gage. The points for measuring may be attached by means of the knurled thumbscrews at various points which are located 1 in. apart, thus allowing the use of one micrometer for readings on parts measuring from 0 to 4 inches.

Grinding Machine for Drills, B-3-T and B-2-T
Grand Rapids Grinding Machine Co., Grand Rapids, Mich.
"American Machinist," July 4, 1918



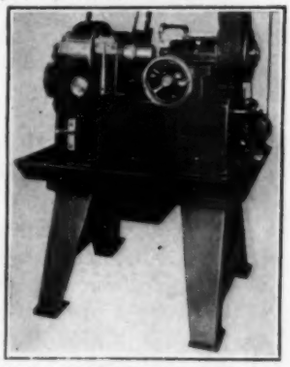
This machine is also made for dry grinding. Spindle speed, 1400 r.p.m.; diameter of grinding wheel, 8½ in.; speed of countershaft, 560 r.p.m.; spindle pulley, 4 x 2¾ in.; driving pulley, 10 x 2¼ in.; tight and loose pulleys, 5 x 2¼ in.; height to center of spindle, 44 in.; floor space, 2 x 3 ft.; diameter of main frame stud, 2¼ in.; swivel bearing, 1½ x 4½ in.; net weight, 455 lb.

Grinding Machine for Drills, C-3-T and C-2-T
Grand Rapids Grinding Machine Co., Grand Rapids, Mich.
"American Machinist," July 4, 1918



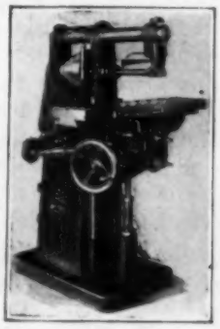
This machine is also made for wet-grinding work. Spindle speed, 1400 r.p.m.; diameter of grinding wheel, 8½ in.; speed of countershaft, 560 r.p.m.; spindle pulley, 4 x 2¾ in.; driving pulley, 10 x 2¼ in.; tight and loose pulleys, 5 x 2¼ in.; height to center of spindle, 44 in.; floor space, 1½ x 3 ft.; diameter of main frame stud, 2¼ in.; swivel bearing, 1½ x 4½ in.; net weight, 330 lb.

Milling Machine, Thread-
Woods Engineering Co., Alliance, Ohio.
"American Machinist," July 11, 1918



For milling threads on shell plugs. While particularly designed for this special work the machine may be used for other classes of commercial chucking work. The plugs for which it was especially designed are of 1- and 2-in. diameter, the former being threaded for a length of ¼ in., and the latter a distance of 1¼ in.

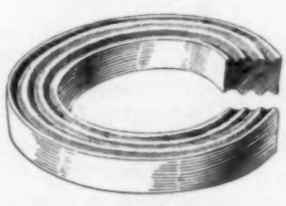
Milling Machine No. 2
Davenport Manufacturing Co., Meadville, Penn.
"American Machinist," June 6, 1918



May be used with hand or power feed as desired. Working surface of table, 36 x 9½ in. with three ⅝ in. T-slots, longitudinal feed, 22 in.; cross-feed, 6½ in.; vertical feed, 19 in.; diameter of overhanging bar, 3¼ in.; distance from bar to center of spindle, 6⅜ in.; diameter of spindle in front bearing, 2⅛ in.; diameter of hole through spindle, ⅞ in.; taper hole in spindle, No. 10 B. & S.; spindle speeds, eight, 65 to 367 r.p.m. right hand; feed changes, six, 0.003 to 0.016 in. per spindle revolution; weight 1800 lb.; floor space, 45 x 58 in.

(This card is to replace the one published on page 46b, Vol. 49.)

Lock Washers, Corrugated, "Red Devil"
Smith-Hemenway Co., Inc., 261 Broadway, New York City
"American Machinst," July 4, 1918



These washers are made of manganese steel, oil tempered, and are put out in a large number of sizes. The advantage claimed for this type of lock washer is that the corrugations give six points of contact which make the device hold better than the ordinary flat type. It is also claimed that it requires 1½ turns of the nut to loosen a corrugated washer, whereas the ordinary type requires but ⅛ of a turn to loosen.

Patent Applied For

Personals

C. D. Miller has been appointed by the Burke Electric Co., of Erie, Penn., manager of its Buffalo branch sales office at 509 Morgan Building, Pearl and Niagara Streets.

Otto A. Berger, president, and **William A. Folger,** second vice president of the Berger & Carter Co., San Francisco, are visiting the machine-tool manufacturers in the East.

Clarence Boyer, who was formerly with the Cincinnati Shaper Co., has been made private secretary to **R. K. LeBlond,** president of the R. K. LeBlond Machine Tool Co., Cincinnati.

Major-Gen. William Crozier has been assigned to command the Department of the Northeast at Boston. He was formerly Chief of Ordnance at Washington. Major-General Crozier relieves **Brigadier-Gen. John W. Ruckman.**

Guy Ellis is now connected with the Emergency Fleet Corporation at Philadelphia. Mr. Ellis was formerly with the Henry Vogt Machine Co. as sales manager and later was manager of the foundry and forging departments.

G. Stanley Porter has resigned as factory manager of the Jackson Rim Co., Jackson, Mich., to become associated with the Hayes Wheel Co., of the same city. Mr. Porter will have charge of the manufacture of fabricated-steel wheels for tractors and trucks.

Bennett Chapple has been appointed director of publicity of the American Rolling Mill Co., Middletown, Ohio. Mr. Chapple has had considerable experience in advertising and journalistic work. He is a partner of Chapple Brothers, Boston, owners of the National Magazine, and was one of its editors.

F. H. Charbono, who for many years has represented the Independent Pneumatic Tool Co. in the East, traveling out of the New York office, has been appointed manager of the Southern district with headquarters at No. 1721 Jefferson County Bank Building, Birmingham, Ala. Mr. Charbono succeeds **George C. Wilson,** who has resigned to look after his interest in the North.

George C. McKay, for five years the sales engineer in southern Ohio and western Pennsylvania for the SKF Ball Bearing Co., Hartford, Conn., has resigned to engage in business as a sales engineer for himself. He has secured the entire factory output of the Automatic Electrical Tool Co. of Cincinnati, Ohio, for a number of years and will devote his time to the marketing of electrical tools for every purpose.

Obituary

Chauncey P. Gross, Sr., president of the Scoville Manufacturing Co., brass manufacturer, died on July 19, 1918, at his home, Waterbury, Conn., aged 80 years. He began work in the office of the Scoville Co. in 1862, and has been its president and treasurer since 1900.

James Damez, president of the Damez Foundry Co., 1380 South Chicago Ave., Chicago, Ill., died in the Illinois Central Hospital July 16, 1918, from injuries received in his plant when an emery wheel broke. He was 70 years old. Mr. Damez was born in Alsace-Lorraine, France, and had been in the foundry business in Chicago for 40 years.

Charles Allis, aged 65, chairman of the Milwaukee County Council of Defense, second son of the late Edward P. Allis, founder of the E. P. Allis Co., died July 22, 1918, of pneumonia, following a serious operation. He was the first president of the reorganized Allis-Chalmers Co., and at the time of his death was president of the Chicago Belting Co., trustee and member of the executive committee of the Northwestern Mutual Life Insurance Co., and a director in the First National Bank and the First Trust Co., Milwaukee. He had given most of his time since the beginning of the war to the Milwaukee County Council of Defense.

Business Items

The Detroit Reamer and Tool Co., 302 Congress St., East Detroit, Mich., has purchased the Welsmore Manufacturing Co. It will continue to manufacture high-speed reamers, cutters, end mills and spiral tools.

The Onondaga Steel Co., Inc., Syracuse, N. Y., which specializes in the manufacture of high-speed steel converted from scrap high-speed steel, has plans under way to erect four additional buildings on its property, which covers 12 acres in Eastwood, a suburb of Syracuse. The structure will be of brick, steel and tile, and will include office, warehouse, annealing and melting buildings. This company has just completed a building 140 x 100 ft. for its rolling mill and hammers.

The Bound Brook Oil-less Bearing Co., Bound Brook, N. J., has perfected arrangements whereby every employee who has been in the service of the company for three months is insured to the amount of $500, increasing with the length of service, payable at his death to whomever he may direct the policy to be issued. The entire expense of the policy is paid by the company. The insurance will apply to the employees of the company's three plants: Plant No. 1 at Bound Brook, N. J., and plants No. 2 and No. 3 at Lincoln, N. J.

Trade Catalogs

Nonpareil Insulating Brick for Furnaces and Ovens. Armstrong Cork and Insulation Co., Pittsburgh, Penn. Leaflet. Pp. 4; 3¾ x 6 in. This leaflet gives a description of the Nonpareil insulating brick, what they accomplish, and treats of the waste-heat subject.

Grinding Wheel Dressers. The Desmond-Stephan Manufacturing Co., Urbana, Ohio. Booklet. Pp. 32; 6 x 9 in. This booklet gives some practical information on the maintenance of grinding wheel by dressing. It illustrates, describes and gives prices of various grinding-wheel dressers manufactured by this company.

Standard Laboratory Tests of Coal, Coke and By-Products. Scientific Materials Co., Pittsburgh, Penn. Booklet. Pp. 32; 6 x 9 in. This booklet contains a description and many halftone illustrations of apparatus for the byproduct laboratory, such as acid-wash test for benzols, boiling-point determinations, coal and coke examinations, apparatus for gas examination, specific-gravity apparatus, stills and fractionating apparatus for light oil, wash oil and tar testing, and special apparatus for tar tests.

High-Frequency Induction Furnaces. Pyrolectric Instrument Co., 636-640 East State St., Trenton, N. J. Loose-leaf catalog, Pp. 26; 8 x 11 in. Illustrations are given of transformers, reactances and switchboard, the oscillatory current system, special forms of inductor coil, the vacuum type of furnace, types of crucibles and transformer. The catalog is descriptive throughout and gives much information regarding the Northrup-Ajax high-frequency induction furnace.

Ball Bearing Manual. The New Departure Manufacturing Co., Bristol, Conn., Pp. 58; 6 x 9 in. This book is more than a mere catalog, being a complete yet concise treatise for users of ball bearings. It discusses the best installation practice and also methods of lubrication and adjustment. The book is profusely illustrated, showing various types of bearings and the correct and incorrect methods in their installation and use. A number of illustrations are also given showing the effects of mistreatment as well as showing the numerous ways in which ball bearings are used in various automobile parts. At the back of the book is a description and price list of various New Departure ball bearings and a table of comparative ball-bearing data showing the trade numbers of various other makes of ball bearings with which the New Departure type are interchangeable. The information given in the book is valuable to anyone having to care for or repair or replace ball bearings.

New Publications

Essentials of Sheet-Metal Work and Pattern Drafting—By James S. Daugherty. One hundred and eighty-one 4¾ x 7¼-in. pages; 149 illustrations; cloth binding. Published by Frederick J. Drake & Co., Chicago. For sale by Peck, Stow & Wilcox Co., Southington, Conn. Price, $1.50.

This book is intended to cover an elementary and advanced course in sheet-metal working for vocational and trade schools and apprentices. It will also be found useful for practical sheet-metal workers, contractors and instructors. The author is instructor in the Carnegie Institute of Technology, Pittsburgh, and presents his subjects in a way that will impress themselves on the minds of students and workers alike. The illustrations and practical examples given make the subjects attractive. The chapters deal with Transferring Patterns to Metal; Cutting Patterns and Templets; Folding Edges and Seaming; Forming, Grooving, Beading and Crimping; Soldering; Double-Hemmed Edge; Wiring Process; Notching and Burring; Double Seaming, Peening and Raising; Radial-Line Developments; Pitched Covers and Flaring Articles; Parallel-Line Development; Pipe Intersections and Tee Joints; Elbows; Return and Face Miters, and Index.

Modern Locomotive Valves and Valve Gears—By Charles L. McShane. Three hundred and thirty-nine 4¾ x 7¼-in. pages; 113 illustrations. Published by Griffin & Winters, New York Life Building, Chicago, Ill. Price, $2.50.

This book treats the subject of locomotive valves and valve gears in a thoroughly up-to-date manner. Beginning in a rather unusual way with a directory of terms, the author leads up from the most elementary principles to the various types of complicated mechanisms. By this treatment he has given a text which may be followed by the youngest apprentice or the experienced engineer. The valve layouts are clearly shown, and the setting problems are given without the usual confusing algebraic formulas and difficult diagrams, and there is no excuse for anyone having the most rudimentary education not to understand the subjects described. Immediately after the list of terms the author takes up slide valves, discusses their advantages and disadvantages, compares piston and slide valve types, describes the necessary functions, methods of construction and operation of the parts, and shows some of the new types. Following this he takes up balanced valves in much the same way and in turn discusses the Allen-Richardson, American, Gould, Mewes, Miller, Miller double-ported, Richardson, Walsh and Wilson types. The chapter on piston valves, which are compared with other types, their construction and operation, describes the Alfree, American semiplug, built-up, solid and Young types. Sheedy's method of converting old inside steam-pipe cylinders into outside steam-pipe cylinders for piston valves is also given. Valve gears include the construction and operation of the Walschaert, Baker, Southern and Young types. The advice given in case of breakdowns is valuable. The practice of giving the names and addresses of firms or individuals wherever the subject warrants is also a good feature and one which many authors overlook. The author is to be congratulated on the handling of his subject in a clear, straightforward manner that is easily grasped and retained.

Forthcoming Meetings

American Society of Mechanical Engineers. Monthly meeting, second Tuesday. Calvin W. Rice, secretary, 29 West 39th St., New York City.

Boston Branch National Metal Trades' Association. Monthly meeting on first Wednesday of each month. Young's Hotel. Donald H. C. Tullock, Jr., secretary. Room 41, 166 Devonshire St., Boston, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting, third Tuesday; section meeting, first Tuesday. Elmer K. Hiles, secretary, Oliver Building, Pittsburgh, Penn.

New England Foundrymen's Association. Regular meeting, second Wednesday of each month. Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45, North Philadelphia, Penn.

Providence Engineering Society. Monthly meeting fourth Wednesday of each month. A. E. Thornley, corresponding secretary, P. O. Box 796, Providence, R. I.

Rochester Society of Technical Draftsmen. Monthly meeting, last Thursday. O. L. Angevine, Jr., secretary, 857 Genesee St., Rochester, N. Y.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting, third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Technical League of America. Regular meeting, second Friday of each month. Oscar S. Teale, secretary, 35 Broadway, New York City.

Western Society of Engineers, Chicago, Ill. Regular meetings, first, second, third and fourth Mondays of each month, except July and August. Edgar S. Nethercut, secretary, 1735 Monadnock Block, Chicago, Ill.

WEEKLY PRICE GUIDE OF

IRON AND STEEL

The Government Schedule of steel prices went into effect Sept. 24. Pig iron was set at $33 per ton; pig iron differentials were announced by the American Iron and Steel Institute on Nov. 3. Washington announced sheet and pipe prices on Nov. 5. Warehouse prices have been revised, as shown, by agreement between the War Industries Board and the warehouses; new schedule in effect Nov. 15. Effective Apr. 1, the price of basic iron was fixed at $32, and standard Bessemer at $35.20 at Valley furnace, prices of other irons remaining the same as last quarter.

PIG IRON—Quotations per ton were current as follows at the points and dates indicated:

	Current	One Month Ago	One Year Ago
No. 2 Southern Foundry, Birmingham	$33.00	$33.00	$47.00
No. 2X, New York	34.40	34.40	53.00
No. 2 Northern Foundry, Chicago	33.00	33.00	55.00
*Bessemer, Pittsburgh	36.60	36.60	55.95
*Basic, Pittsburgh	32.00	32.00	52.95
No. 2X, Philadelphia	34.40	34.40	54.50
*No. 2, Valley	33.00	33.00	53.95
No. 2 Southern Cincinnati	36.90	36.90	49.90
Basic, Eastern Pennsylvania	32.90	32.90	50.00

*Delivered Pittsburgh; f.o.b. Valley, 95 cents less.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$4.245	$4.195	$5.25	$4.17	$4.50	$4.27	$5.00
Soft steel bars	4.145	4.095	5.00	4.07	5.00	4.17	4.50
Soft steel bar shapes	4.145	4.095	5.00	4.17	4.50	4.17	4.50
Soft steel bands	4.995	....	....	....	....	....	....
Plates, ¼ to 1 in. thick	4.495	4.445	9.00	4.42	8.00	4.52	8.00

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Pittsburgh, mill	$3.50	$5.25
Warehouse, New York	4.75	4.75
Warehouse, Cleveland	4.10	4.95
Warehouse, Chicago	4.10	4.50

STEEL SHEETS—The following are the prices in cents per pound from jobbers' warehouse at the cities named:

	Pittsburgh, Mill, in Carloads	New York			Cleveland		Chicago	
		Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
*No. 28 black	5.00	6.495	6.445	10.50	6.42	9.00	6.52	10.00
*No. 26 black	4.90	6.395	6.345	10.40	6.32	8.90	6.42	9.90
*Nos. 22 and 24 black	4.85	6.345	6.295	10.35	6.27	8.85	6.37	9.85
Nos. 18 and 20 black	4.80	6.295	6.245	10.30	6.22	9.20	6.32	9.80
No. 16 blue annealed	4.45	5.695	5.645	10.20	5.62	9.20	5.72	10.20
No. 14 blue annealed	4.35	5.595	5.545	10.10	5.52	9.10	5.62	10.10
No. 10 blue annealed	4.25	5.495	5.445	10.00	5.42	9.00	5.52	10.00
*No. 28 galvanized	6.25	7.745	7.695	13.00	7.67	10.75	7.77	11.50
*No. 26 galvanized	5.95	7.445	7.395	12.70	7.37	10.45	7.32	11.20
No. 24 galvanized	5.80	7.295	7.245	12.55	7.22	10.30	7.47	11.05

*For painted corrugated sheets add 30c. per 100 lb. for 25 to 28 gage; 25c. for 19 to 24 gage; for galvanized corrugated sheets add 5c., all gages.

COLD DRAWN STEEL SHAFTING—From warehouse to consumers requiring at least 1000 lb. of a size (smaller quantities take the standard extras) the following discounts hold:

	Current	One Year Ago
New York	List plus 13%	List plus 25%
Cleveland	List plus 13%	List plus 10%
Chicago	List plus 13%	List plus 10%

DRILL ROD—Discounts from list price are as follows at the places named:

	Extra	Standard
New York	35%	40%
Cleveland	35%	40%
Chicago	35%	40%

SWEDISH (NORWAY) IRON—The average price per 100 lb., in ton lots, is:

	Current	One Year Ago
New York	$15.50–19	$14.00
Cleveland	20.00	13.30
Chicago	19.00	12.50

In coils an advance of 50c. usually is charged.

Note—Stock very scarce generally.

WELDING MATERIAL (SWEDISH)—Prices are as follows in cents per pound f.o.b. New York, in 100-lb. lots and over:

Welding Wire*		Cast-Iron Welding Rods	
⅜, ¼, 5/16, ½, 7/16, 9/16, No. 8, ⅝ and 11/16, No. 10	22.10 to 33.00	⅜ by 12 in. long	16.00
⅛		½ by 10 in. long	14.00
No. 12		⅝ by 10 in. long	12.00
No. 14 and 7/64		½ by 21 in. long	12.00
No. 18		*Special Welding Wire	
No. 20		¼	33.00
		5/16	30.00
		⅜	32.00

* Very scarce.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Tire	4.15	4.07	4.17
Toe calk	5.75	4.57	4.32
Openhearth spring steel (heavy)	8.00	8.00	7.60
Spring steel (light)	11.00	11.25	11.90
Coppered bessemer rods	9.00	8.00	7.07
Hoop steel	4.99½	4.75	5.02
Cold-rolled strip steel	8.50	8.25	8.57
Floor plates	6.50	6.00	7.07

PIPE—The following discounts are for carload lots f.o.b. Pittsburgh; basing card of Nov. 6, 1917, for steel pipe and for iron pipe:

BUTT WELD

Steel Inches	Steel Black	Steel Galvanized	Iron Inches	Iron Black	Iron Galvanized
⅛, ¼ and ⅜	44%	17½%	⅜ to 1½	33%	17%
½	48%	33½%			
⅝ to 3	51%	37½%			

LAP WELD

2	44%	31½%	2	26%	12%
2½ to 6	47%	34½%	2½ to 4	28%	15%
			4½ to 6	28%	15%

BUTT WELD EXTRA STRONG PLAIN ENDS

⅛, ¼ and ⅜	40%	22½%	⅜ to 1½	33%	18%
½	45%	32½%			
⅝ to 1½	49%	36½%			

LAP WELD. EXTRA STRONG PLAIN ENDS

2	42%	30½%	2	27%	14%
2½ to 4	45%	33½%	2½ to 4	29%	17%
4½ to 6	44%	32½%	4½ to 6	28%	16%

Stock discounts in cities named are as follows:

	New York Black	New York Galvanized	Cleveland Black	Cleveland Galvanized	Chicago Black	Chicago Galvanized
¾ to 3 in. steel butt welded	33%	16%	43%	28%	41.9%	26.9%
3½ to 3 in. steel lap welded	15%	+3%	39%	25%	37.9%	23.9%

Malleable fittings, Class B and C, from New York stock sell at list price. Cast iron, standard sizes, 10 and 5%.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	One Month Ago	One Year Ago
Copper, electrolytic	26.00*	23.50	27.50
Tin in 5-ton lots	94.00	85.00	63.75
Lead	8.05	7.25	11.00
Spelter	8.62½	7.50	8.50

*Government price.

ST. LOUIS

Lead	7.75	7.25	10.75
Spelter	8.37½	7.10	8.25

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York Current	New York One Month Ago	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Copper sheets, base	38.00	32.50	38.00	38.00	40.00	33.50	39.40
Copper wire (carload lots)	35.00	31.00	38.50	35.00	39.00	33.00	38.50
Brass sheets	39.75	31.75	40.00	37.00	36.00	31.50	42.00
Brass pipe	46.00	36.50	43.00	42.00	46.00	41.50	46.50
Solder (half and half) (case lots)	60.00	70.00	39.25	62.00	39.50	70.00	39.25

Note:—Solder very scarce.

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 1c.; polished takes 1c. per sq.ft. extra for 20-in. widths and under; over 20 in., 2c.

BRASS RODS—The following quotations are for large lots, mill, 100 lb. and over, warehouse; 25% to be added to mill prices for extras; 50% to be added to warehouse price for extras:

	Current	One Year Ago
Mill	$32.25	$42.00
New York	34.25	45.50
Cleveland	35.00	38.00
Chicago	29.50	42.50

ZINC SHEETS—The following prices in cents per pound prevail:

Carload lots f.o.b. mill 15.00

	In Casks Current	In Casks One Year Ago	Broken Lots Current	Broken Lots One Year Ago
Cleveland	18.75	21.00	18.40	21.50
New York	16.50	23.00	17.00	23.25
Chicago	22.00	22.50	21.50	23.50

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots, for spot delivery, duty paid:

	Current	One Year Ago
New York	13.25	16.00
Chicago	13.50	18.50
Cleveland	16.00	19.00

SHOP MATERIALS AND SUPPLIES

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York Current 1918	New York One Yr. Ago	Cleveland Current 1918	Cleveland One Yr. Ago	Chicago
Copper, heavy and crucible	23.50	23.50	24.00	26.75	23.50
Copper, heavy and wire..	22.50	22.50	23.50	25.75	23.25
Copper, light and bottoms.	20.50	20.50	21.00	22.00	22.00
Lead, heavy	7.00	8.50	21.50	9.20	7.85
Lead, tea	5.25	6.50	7.50	6.50	6.50
Brass, heavy	14.75	15.00	6.00	17.00	23.50
Brass, light	11.00	11.00	12.50	13.50	13.00
No. 1 yellow brass turnings	13.00	15.50	14.00	15.00	13.50
Zinc 5.75	6.25	6.00	6.50	7.00	6.35

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, guaranteed over 99% pure, in ingots for remelting (ton lots) per lb.	32.10c.	32.20c.	33½c.

This is the Government price for lots of from 1 to 14 tons.

COPPER BARS from warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York	42.00	41.00
Chicago	38.00	39.00
Cleveland	36.50	41.00

BABBITT METAL—Warehouse price per pound:

	New York Current	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Best grade	125.00	70.00	108.00	71.75	100.00	70.00
Commercial	70.00	40.00	23.00	24.50	24.00	25.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York Current	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Hot pressed square	$2.50*	List	$1.20	$1.65	$1.05	$3.00
Hot pressed hexagon	2.50*	List	1.00	1.50	.85	3.00
Cold punched square	2.50*	List	.75	1.40	1.00	1.60
Cold punched hexagon	2.50*	List	.75	1.40	1.00	2.00

* List plus.

Semifinished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	40%	50%
Chicago	50%	50%
Cleveland	60%	50%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
⅝ by 4 in. and smaller	30%	46%	37%
Larger and longer up to 1 in. by 30 in.	15%	40%	25—5%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York $2.50 Cleveland $3.00 Chicago $2.50

For cast-iron washers the base price per 100 lb. is as follows:
New York $5.00 Cleveland $4.00 Chicago $3.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
⅝ by 4 in. and smaller	30%	46%	37%
Larger and longer up to 1 in. by 30 in.	15%	40%	25—5%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets Current	Rivets One Year Ago	Burs Current	Burs One Year Ago
Cleveland	List plus 10%	List plus 10%	List plus 10%	List plus 10%
Chicago	List price	List price	List plus 20%	List price
New York	20% from list	10-2½% from list	List plus 20%	10-2½% from list

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ¼ and smaller	30%	45—5%	45%*
Tinned	30%	45—5%	45%*

Button heads, ¾, ⅞, 1 in. diameter by 2 in. to 5 in. sell as follows per 100 lb.
New York $5.65 Cleveland $5.15 Chicago $5.67 Pittsburgh $4.65
Coneheads, same sizes:
New York $5.75 Cleveland $5.25 Chicago $5.77 Pittsburgh $4.75

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	49.00	42.50	39.50
Brass	40.00	40.00	44.00

For immediate stock shipment 3c. is usually added. The prices of course vary with the quantity purchased. For lots of less than 100 lb. but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb. but not less than 50 lb., the advance is 2½c. over base (100-lb. lots); for less than 50 lb. but not less than 25 lb., 5c. should be added to the base price; and for quantities under 25 lb. the increase above base is 10c.

TIN PLATES—Warehouse prices per box:

Coke tin plate, 14 x 20:

	Cleveland Current	Cleveland One Yr. Ago	Chicago Current	Chicago One Yr. Ago
100 lb.	$10.00	$12.00	$10.60	$11.75
I. C. 107 lb.	10.15	12.17½	10.70	11.90

Terne plate, 20 x 28:

Base Weight	Net Weight	Coating				
100 lb.	200	3	18.95	18.70	19.10	17.50
I. C.	214	8	19.25	19.00	19.40	17.85
I. C.	270	8	21.75	21.50	21.40	19.95
I. C.	218	12	21.75	19.85	22.60	18.85
I. C.	221	15	22.50	20.35	22.10	19.10
I. C.	226	30	23.25	21.75	22.60	20.15
I. C.	231	25	24.50	22.20	23.10	20.90
I. C.	236	30	25.75	23.50	23.60	21.85
I. C.	241	35	26.75	24.50	25.10	22.85
I. C.	246	40	28.00	25.75	25.60	24.15

NOTE—New York prices furnished on application to dealers. Price varies according to whether the plates are wanted for work essential to the war or for nonessential work.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	New York One Year Ago	Cleveland	Chicago
White	11.00 to 13.00	13.00	16.50	12.00 to 16.50
Colored mixed	8.50 to 12.00	12.00	13.00	11.50 to 14.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13¼ x 13¼	13¼ x 20½
Cleveland	52.00	58.00
Chicago	48.00	50.00

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$1.75	$1.75	$1.75
Philadelphia	1.75	1.75	1.75
Cleveland	2.40	2.35	2.00
Chicago	2.00	2.00	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$4.30	$4.30	$2.85
Cleveland	4.60	4.50	4.60
Chicago	4.00	4.00	3.25

COKE—The following are prices per net ton at ovens, Connellsville, and cover the past four weeks:

	Aug. 1	July 25	July 17	July 10	July 3	June 27
Prompt furnace	$6.00	$6.00	$6.00	$6.00	$6.00	$6.00
Prompt foundry	7.00	7.00	7.00	7.00	7.00	7.00

FIRE CLAY—The following prices prevail:

		Current
Chicago	450-lb. bbl.	$2.50
Cleveland	375-lb. bag	2.50

LINSEED OIL—These prices are per gallon:

	New York Current	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Yr. Ago
Raw in barrels	$1.86	$1.16	$2.05	$1.20	$2.03	$1.17
5-gal. cans	1.96	1.26	2.25	1.35	2.23	1.27

WHITE AND RED LEAD in 500-lb. lots sell as follows in cents per pound:

	Red Current Dry	Red Current In Oil	Red 1 Year Ago Dry	Red 1 Year Ago In Oil	White Current Dry and In Oil	White 1 Year Ago Dry and In Oil
100-lb. keg	14.00	14.50	13.25	13.50	14.00	13.00
25 and 50-lb. kegs	14.25	14.75	13.50	13.75	14.25	13.25
12½-lb. keg	14.50	15.00	13.75	14.00	14.50	13.50
5-lb. cans	——	——	15.25	15.50	16.00	15.50
1-lb. cans	——	——	15.25	15.50	17.00	15.50

NEW *and* ENLARGED SHOPS

Consult the Buying Section when in need of machinery or supplies

WASHINGTON, D. C.

The Navy aims to give information regarding its purchases to all manufacturers known to be in a position to supply its demand. Owing to the need of prompt action in the cases of all machine tools hereinafter listed, the Navy cannot arrange to permit a postponement of the opening of bids if the manufacturers are able to secure bidding forms and submit their bids prior to date fixed for opening.

In case time does not permit this, it will be appreciated if any manufacturer not receiving information directly regarding these purchases will notify the Purchasing Division, Bureau of Supplies & Accounts, Navy Department, Washington, D. C., in order that the firm's name may be properly listed for all future purchases.

The Bureau of Supplies and Accounts, Navy Department, will soon receive bids for furnishing machines and machine tools as follows:

Schedules Nos. 5315½, 5316½, 5326½, 5327½, 5328½, 5329½, 5330½, 5331½, 5332½, 5333½, 5334½, 5345½, 5346½, 5347½, 5348½, 5349½, 5340½, 5341½, 5342½, 5343½, 5350½, 5351½, machine tools.

Schedule No. 5325½, machine tools, delivery Wash., D. C.

Schedule No. 5382½, machine tools, delivery Pensacola, Fla.

Schedules Nos. 5379½ and 5383½, machine tools, delivery Newport, R. I.

The Bureau of Supplies and Accounts, Navy Department will receive bids for furnishing machines and machine tools, as follows:

August 16th—Schedule 5171½, machine tools, delivery, Norfolk, Va.

Schedule No. 5173½, threading mill machine, delivery Newport, R. I.

Schedule No. 5174½, cutter and tool grinder, delivery Newport, R. I.

August 19th—Schedule 5324½, machine tools, delivery Wash., D. C.

Schedule No. 5232½, machine tools, delivery, Newport, R. I.

August 20th—Schedule No. 1892, drills, gauges, etc., delivery East and West Navy Yard.

Schedules Nos. 1893 and 1894, machine tools, delivery Wash., D. C.

August 23rd—Schedule No. 5345½, screw machines, delivery Wash., D. C.

Schedules Nos. 5227½, 5228½, 5229½ and 5230½, machine tools, delivery, Newport, R. I.

Schedule No. 5347½, mixing machines, delivery f.o.b.

Schedule No. 5363½, surface grinders, delivery, Wash., D. C.

Schedules Nos. 5231½, 5237½, 5228½, 5230½, machine tools, delivery Newport, R. I.

August 26th—Schedule No. 5229½, machine tools, delivery Newport, R. I.

August 27th—Schedule No. 1899, machine tools, delivery Wash., D. C.

The Bureau of Supplies and Accounts, Navy Department, received bids for furnishing machines and machine tools, as follows:

Schedule No. 5007½, Class 691; (Item 1)—3 oxy-acetylene welding sets, delivery f.o.b. cars, from Bertschy Manufacturing Engineering Co., 20th and Harney St., Omaha, Neb., $251; Bastian Blessing Co., 125 West Austin Ave., Chicago, Ill., $460; Bishop, Babcock & Becker Co., 376 Lafayette St., New York City, $301. Davis Bournonville Co., Jersey City, N. J., $275; A. Milburn Co., 1420 West Baltimore St., Baltimore, Md., $225; Oxweld Acetylene Co., 640 Freylinghuysen Ave., Newark, N. J., $385; Torchweld Equipment Co., 224 North Carp St., Chicago, Ill., $150.

Schedule No. 4955½, Class 695; (Item 1)—1 belt driven extension gap, heavy duty, triple geared, screw cutting lathe; Class 696; (item 4)—one 14 x 72 in., plain, cylindrical, grinding machine; Class 697; (item 5)—one 10 to 12 in., belt driven, slotting machine; delivery f.o.b. cars, from Manning, Maxwell & Moore, 119 West 40th St., New York City, (1) $10,436, (4) $3640, (5) $3060; Niles, Bement & Pond, 111 Bway., New York City, (1) $6300; D. Nast Machine Tool Co., Bourse St., Philadelphia, Penn., (1) $10,490; H. Prentiss Co., 149 Bway., New York City, (1) $6475; W. F. Davis Machine Tool Co., 945 Pennsylvania Ave., Wash., D. C., (4) $2955; Landis Tool Co., Waynesboro, Penn., (4) $3550; Sherritt & Stoer Co., Finance Bldg., Philadelphia, Penn., (4) $2895, (5) $2930; Kemp Machine Co., 223 North Calvert St., Baltimore, Md., (5) $3200; Newton Machine Tool Works, 23rd and Vine St., Philadelphia, Penn., (5) $3500, $5000; Shipley Machine Co., Morris Bldg., Philadelphia, Penn., (5) $3150.

Schedule 4950½, Class 617; (Item 2)—Six 16 in., universal saws, delivery Brooklyn, N. Y., from American Woodwork Machine Co., 591 Lyell St., Rochester, N. Y., $1153, $667.50; J. A. Fay & Egan Co., John and Front St., Cincinnati, Ohio, $1109, $1207, $1264, $464; Kemp Machine Co., 223 North Calvert St., Baltimore, Md., $895, $385; Machinery Merchants & Co., 50 Church St., New York City, $813; Manning, Maxwell & Moore, 119 West 40th St., New York City, $878, $350; Machine Tool Engineering Co., 149 Bway, New York City, $853; Niles, Bement & Pond, 111 Bway., New York City, $640, $855; Oliver Machine Co., 50 Church St., New York City, $1175, $1090, $940.

Schedule 4956½, Class 717, (Item 1)—two 8 in. motor driven, precision, bench lathes, (Item 1a)—2 sets of carbon brushes for motor, Item 1; Class 719, (Item 3)—1 motor driven, horizontal, boring drilling and milling machine; Class 720, (Item 4)—one 6 in. capacity, motor driven, cold metal saw; Class 721, (Item 5)—one 24 in. feed, gear, drill press; Class 724, (Item 8)—one 3 lb., slip roll forming, hand operated, tinsmith machine, with floor legs, delivery f.o.b. cars, from Fairbanks Co., Colorado Bldg., Wash., D. C., (1-1a) $2,398; Kemp Machinery Co., 223 North Calvert St., (1-1a) $2,001, alternate, $3,566, (5) $1,751, $1,925; D. Nast Machine Co., Bourse Bldg., Philadelphia, Penn., (1-1a) $2,440, alternate, $3,496, (3) $4,980, alternate, $4,890, $4,975, (4) $692, (5) $720, $785, (8) $135; Rivett Lathe & Grinder Co., Newton St., Boston, Mass., (1-1a) $3,342; Sherritt & Stoer Co., Inc., Finance Bldg., Philadelphia, Penn., (1-1a) $2,472, (3) $6,459, (4) $692; W. E. Shipley Machine Co., Morris Bldg., Philadelphia, Penn., (1-1a) $3,642, $3,640; Earle Gear and Machinery Co., Stanton and Wyoming St., Philadelphia, Penn., (3) $6,452, (4) $1,580; Greenfield Tap and Die Corporation, Greenfield, Mass., (3) $6,534, (4) $888; Manning, Maxwell & Moore, 119 West 40th St., New York City, (3) $7,400, (4) $1,474, (5) $1,695, (8) $140; Swind Machine Co., Widener Bldg., Philadelphia, Penn., (3) $6,450, (4) $990; Newton Machine Tool Works, 23rd and Vine St., Philadelphia, Penn., (4) $1,614, $1,660; Hoefer Manufacturing Co., Freeport, Ill., (5) $1,165; Niagara Machine and Tool Works, 683 Northland Ave., Buffalo, N. Y., (8) $122, $131; Peck Stow & Wilcox, Southington, Conn., $126.90.

Schedule 5038½, Class 743, (Item 7)—1 motor driven, grinding machine drill; Class 744, (Item 8)—1 grinding machine drill, delivery Navy Yard, Wash., D. C., from W. F. Davis Machine Tool Co., 945 Pennsylvania Ave., Wash., D. C., (7) $165; Aumen Machine Co., 107-9 East Lombard St., Baltimore, Md., (7) $205, $199; Kemp Machine Co., 223 North Calvert St., Baltimore, Md., (7) $162; D. Nast Machine Co., Bourse Bldg., Philadelphia, Penn., (7) $200, $250; Manning, Maxwell & Moore, 119 West 40th St., New York City, (7) $190, (8) $190; Southern Electric Co., 16 Light St., Baltimore, Md., (7) $159; Sherritt & Stoer Co., Finance Bldg., Philadelphia, Penn., (8) $195.

Schedule No. 5084½, Class 752, (Item 1)—1 box board matcher, complete with motor drive, delivery Navy Yard, Norfolk, Va., from Hall & Brown Wood working Machine Co., 1913 North Bway, St. Louis, Mo., $1,182, alternate, $993; P. B. Yates Machine Co., Beloit, Wis., $1,716.

Schedule No. 4825½, Class 754, (Item 1)—one 12 x 48 in. motor driven, thread milling machine, exclusive of all spares, deliver Navy Yard, Philadelphia, Penn., from Pratt & Whitney Co., 436 Capitol Ave., Hartford, Conn., $6,735; Swind Machinery Co., Widener Bldg., Philadelphia, Penn.,

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The Bureau of Supplies and Accounts, Navy Department, has awarded the contract for furnishing machines and machine tools, as follows:

Schedule No. 4648½, Class 317, planer, to Gleason Works, 1000 University Ave., Rochester, N. Y., $4191.

Schedule No. 4652½, Class 321, jig boring machine, to Pratt & Whitney Co., 436 Capitol Ave., Hartford, Conn., $7163.

Schedule No. 4655½, Class 324, radial drill, to Niles-Bement & Pond, 111 Bway., New York City, $3955.

Schedule No. 4628½, Class 295, boring bars, to Monarch Machinery Co., 300 North 3rd St., Philadelphia, Penn., $4573.

Schedule No. 4629½, Class 296, portable cranes, to Manning, Maxwell & Moore, 119 West 40th St., New York City, $1072.

Schedule No. 4695½, Class 388, planer, to Niles-Bement & Pond, 111 Bway., New York City, $69,900.

Schedule 4725½, Class 436, heavy duty milling machines, to Manning, Maxwell & Moore, 119 West 40th St., New York City, $7232.

Schedule 4854½, Class 473, lathes, to Fairbanks Co., Colorado Bldg., Wash., D. C., $3996.

Schedule No. 4813½, Class 501, shaper, to Hollingsworth Machine Tool Co., Covington, Ky., $1085; Class 502, sensitive drill, to D. Nast Machine Co., Bourse Bldg., Philadelphia, Penn., $186.

Schedule No. 4934½, Class 693, welding outfit, to Davis Bournonville Co., Van Wagner Ave., Jersey City, N. J., $2218; Alexander Milburn Co., 1420 West Baltimore St., Baltimore, Md., $5250; Air Reduction Sales Co., 120 Bway., New York City, $7,200.